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Page 25, 2d line from bottom (footnote), *for* No. 2, *read* No. 1.

Page 54, 10th line, *for* yellew *read* yellow.

Page 60, 1st line, *insert* a hyphen at the end of the line.

Page 102, 3d line, for *matricariaefolium* read *neglectum.*

Page 125, last line (footnote), *complete the brackets.*

Page 155, last line, *for* successively *read* successfully.

Page 163, 12th line from bottom, *for* The problems *read* The progress.

Page 195, 10th line, *for* others *read* other.

Page 207, 12th line from bottom, *for* Lause *read* Lancelot.

Page 217, last line, *for* ew *read* New.

Page 218, 7th line, *for* OEningen *read* Oeningen.

Page 232, 6th line, *for* Karston *read* Karsten.

Page 233, 2d line from bottom (footnote), *for* Radioactivity and Life *read* " Radioactivity and Life ".

Page 237, 2d line, *for* Linnaeus " *read* Linnaeus.

Page 237, 3d line, *for* Specific *read* " Specific.

Page 246, 5th line, *omit* comma *before* are.

Page 250, end of the 12th line from bottom, substitute comma for the period.

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# TORREYA

January, 1908

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THE PINE-BARRENS OF BABYLON AND ISLIP, LONG ISLAND

BY ROLAND M. HARPER

To the botanist who regards a habitat merely as a place where certain species of plants may be found, the pine-barrens to be described below possess few attractions, for their flora is not very rich, and nearly all the species are pretty widely distributed and well known. But to the phytogeographer every habitat that has not been too much disfigured by civilization is of interest, whether its plants are few or many, common or rare; so no apology is necessary for publishing the following notes.

The pine-barrens of Long Island are very easy of access, but they seem never to have been adequately described, chiefly for the reason given above. Brief references to them occur in some old historical works, such as B. F. Thompson's History of Long Island (1839), on page 16 of which is the following statement: "There is another extensive tract lying eastward from the Hempstead plains, and reaching to the head of Peconic Bay, composed so entirely of sand as to seem in a great measure incapable of profitable cultivation by any process at present known."

The first distinct published list of Long Island pine-barren plants seems to be that of Dr. N. L. Britton (Bull. Torrey Club 7: 82. 1880), who selected from Miller & Young's flora of Suffolk County, N. Y. (published in 1874) 46 species which he had found in New Jersey and on Staten Island to be confined to the coastal plain, or nearly so. Essentially the same list was copied by Dr. Arthur Hollick in 1893 (Trans. N. Y. Acad. Sci.

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12: 192), by Dr. S. E. Jelliffe in 1899 (Fl. L. I., xi–xii), and by Dr. J. W. Harshberger in 1904 (Proc. Acad. Nat. Sci. Phila. **56**: 605).

The pine-barrens of Long Island are almost confined to the southern half of Suffolk County, but extend a few miles westward into Nassau, mostly in the shape of isolated patches. Dr. W. C. Braislin (Abstr. Proc. Linn. Soc. N. Y. **17–19** (**1904–1907**): 94. O 1907) places "the western limit of the scrub pines" at Central Park, about three miles west of the county line, where there are perhaps three or four hundred acres of pine-barrens; but I have seen other unmistakable patches of the same vegetation two or three miles farther west, namely, between Hicksville and Westbury and also about half way between Merrick and Hicksville.

The pine-barren area corresponds approximately with that of the soil mapped as "Norfolk coarse sandy loam" in the soil survey report on western Long Island by J. A. Bonsteel and others (Field Operations of the U. S. Bureau of Soils for 1903). Like most other unglaciated portions of Long Island, it is almost perfectly flat, with a barely perceptible southward slope of about 15 feet to the mile. A few very shallow valleys containing brooks or creeks traverse it, generally from north to south. It lies entirely south of the newer or Harbor Hill moraine, but partly north of the older or Ronkonkoma moraine. The soil seems to be of the Columbia formation, one of the youngest of coastal plain deposits. Its chief constituents here are silt and coarse sand. Just why pines should predominate on the "Norfolk coarse sandy loam" and deciduous trees on some equally sandy soils similarly situated a little farther west is not clear. It cannot be altogether a matter of water-content, for the pines occur also well within the edges of the swamps.

In Babylon and Islip, the two westernmost townships on the south side of Suffolk County, pine-barrens are the prevailing type of vegetation, and as there are a good many square miles of them in these townships entirely uninhabited, they are in excellent condition for study. My observations on the flora of Babylon and Islip have been confined to three trips on foot

across the pine-barrens from north to south in the fall of 1907. On October 6 I traversed the pine-barrens of Islip in going from Smithtown to Babylon by way of Brentwood and Edgewood; five days later I went from Hicksville to Babylon (station) by way of Pinelawn, and on November 3 from Cold Spring station to Amityville, the latter half of this journey being also through the township of Babylon.

There seem to be only two natural types of vegetation in the region under consideration, namely, dry pine-barrens and swamps. The swamps are confined to narrow belts along the streams, and the only one I have examined is that of Santapogue Creek, two

FIGURE 1. Dry pine barrens about one-half mile south of Edgewood station (town of Islip), Oct. 6, 1907. Trees all *Pinus rigida*, the largest about 9 inches in diameter and 30 feet tall. Undergrowth almost entirely *Quercus ilicifolia* and *Q. prinoides* in equal proportions, about 4 feet tall. The picture embraces a horizontal angle of about 36°. This scene is typical of thousands of acres in both townships.

or three miles west of Babylon station. The dry pine-barrens are fairly uniform over many square miles, the principal natural variation being that toward the northern edge the shrubs are

smaller and the herbs more numerous than elsewhere. Southward the arborescent species of oaks become larger and more numerous and gradually crowd out the pines. The northern boundary of the pine-barrens seems to be more sharply defined.

The average appearance of the dry pine-barrens is illustrated better by the accompanying photographs * than it could be by any description. The pines are the dominant feature of the landscape, and the underbrush consists chiefly of a dense growth of two shrubby oaks,† all the individuals of both reaching approximately a uniform height in any one locality. The herbs are more numerous in species, but more scattered and inconspicuous. The dry pine-barrens have probably always been subject to occasional fires, which since the advent of civilized man have become frequent enough to kill a good many of the pines but otherwise have perhaps caused little change.

The species observed in this habitat in the two towns mentioned are as follows. They are divided first into trees, shrubs, and herbs, and then arranged approximately in order of abundance in each class.

TREES	HERBS
Pinus rigida	*Pteridium aquilinum*
Quercus alba	*Ionactis linariifolius*
Quercus coccinea	*Cracca virginiana*
Quercus stellata (*Q. minor*)	*Baptisia tinctoria*
Populus grandidentata	*Dasystoma pedicularia*
SHRUBS	*Solidago bicolor*
Quercus ilicifolia (*Q. nana*)	*Andropogon scoparius*
Quercus prinoides	*Solidago odora*
Comptonia peregrina	*Lespedeza hirta*
Pieris Mariana	*Sericocarpus linifolius*
Gaylussacia resinosa	*Helianthemum* sp.
(and others ?)	*Sericocarpus asteroides*

* None of the existing local floras of Long Island is illustrated, so far as known to the writer, so these may be the first photographs of Long Island pine-barren vegetation ever published.

† These two oaks are remarkably similar in appearance, considering that they belong to different sections of the genus. See in this connection Rehder, Rhodora 9 : 61. 1907.

Vaccinium spp.
Smilax glauca
Rhus copallina
Arctostaphylos Uva-ursi
Chrysopsis Mariana
Aster concolor
Epilobium angustifolium
Gaultheria procumbens.

Besides these, *Aster spectabilis*, *Laciniaria scariosa*, *Lespedeza capitata*, and *Sarothra gentianoides* were seen along some of the roads, and they may perhaps also occur naturally in the pine-barrens. *Chrysopsis falcata*, which is commonly regarded as a typical northern pine-barren plant, I have found only on a gravelly hill in Smithtown,* and (abundantly) in gravel between the rails

FIGURE 2. Two scenes in the pine-barrens of Babylon, Oct. 11, 1907. At left, dry pine-barrens about a mile south of Pinelawn. Pines growing more densely than usual. Oaks mostly *Q. ilicifolia*, four or five feet tall. At right, east edge of swamp of Santapogue Creek, looking south, just above the road from Farmingdale to Babylon. Shows principally *Pinus*, *Acer*, and *Betula*.

of an old railroad which runs eastward from Garden City, Nassau County. *Hudsonia ericoides*, another supposed pine-barren plant, I have seen only on a high gravelly hill in the southwestern part

* Most of the stations cited for it in Jelliffe's Flora of Long Island are on the north side of the island, among the hills.

of the town of Huntington, just north of Babylon. *Corema Conradii* may possibly occur somewhere in this region, for according to Mr. J. H. Redfield* it is associated, wherever it grows, with a good many of the species listed above.

The flora of the swamps is considerably richer than that of an equal area of dry pine-barrens. The single pine-barren swamp examined on October 11 contained the following species, some on its edges, some right in the stream, and some in intermediate positions.

TREES	HERBS
Acer rubrum	*Osmunda cinnamomea*
Nyssa sylvatica	*Dulichium arundinaceum*
Pinus rigida	*Carex stricta*
Betula populifolia	*Osmunda spectabilis* (*O. regalis*)
SHRUBS	*Sparganium* sp.
Clethra alnifolia	*Lysimachia terrestris*
Alnus rugosa	*Eriophorum virginicum*
Myrica carolinensis	*Dryopteris Thelypteris ?*
Ilex glabra	*Panicularia canadensis*
Chamaedaphne calyculata	*Pteridium aquilinum*
Azalea viscosa	*Aster* sp.
Leucothoë racemosa	*Eupatorium verbenaefolium ?*
Xolisma ligustrina	*Andropogon corymbosus abbreviatus* †
Rhus Vernix	
Kalmia angustifolia	*Viola primulaefolia*
Azalea viscosa glauca	*Solidago arguta ?*
Ilex verticillata	*Habenaria ciliaris ?*
Cephalanthus occidentalis	*Lilium philadelphicum*
Viburnum cassinoides	*Sphagnum* sp.
Spiraea salicifolia	(and a few other mosses)

Chamaecyparis thyoides, which grows in some more or less similar swamps in Nassau County, ‡ and *Polygala lutea*, which is

* Bull. Torrey Club 11 : 97–101. 1884.

† Described in Britton's Manual 70. 1901. Formerly referred to the more southern *A. glomeratus* (Walt.) B.S.P. (*A. macrourus* Michx.).

‡ See Torreya 7 : 198–200. O 1907.

said to have been found in or near this particular swamp, I did not see. *Magnolia glauca* (*M. virginiana*) might have been expected in such a place, but apparently it is not known from the western half of Long Island.

Nearly half the shrubs in both habitats are of the Ericaceae and closely allied families. The Compositae constitute nearly half the herbs noted in the uplands and a considerable proportion of those in the swamps; but more complete lists, including spring and summer flowers which become unrecognizable in the fall, would doubtless show a smaller proportion of this family. Evergreens other than pines are very scarce in the dry pine-barrens and not very numerous in the swamps.

The most interesting features of this pine-barren vegetation are brought out by a study of the geographical distribution of its components. For the sake of brevity the species of both habitats may be combined, since it happens that the geographical affinities of both are much the same.

Not one of the species whose identity is certain is confined to the coastal plain, though *Pieris Mariana*, *Clethra*, *Myrica*, *Ilex glabra*, and *Eupatorium verbenaefolium* are mainly so.* On the other hand, *Arctostaphylos*, *Betula populifolia*, and *Panicularia canadensis* are chiefly confined to the glaciated region. *Azalea viscosa*, *Leucothoë*, *Dulichium*, and *Eriophorum* are widely distributed both in the glaciated region and coastal plain, and also occur more rarely in bogs in the southern Alleghanies.† Nearly all the species are common in New England, especially in the southeastern portion.‡ At least one-third of the dry pine-barren plants are common to

* Nearly all the few endemic coastal plain species known from Long Island seem to be bog plants, confined for some reason not fully understood to the eastern half of the island.

† See Rhodora 7: 72–76. 1905. At that time I supposed *Dulichium* to be strictly confined to the glaciated region and coastal plain, but I have since noticed that it has been reported from the mountains of Kentucky by Kearney (Bull. Torrey Club 20: 479. 1893) and from Cullman County, Alabama, by Mohr (Contr. U. S. Nat. Herb. 6: 396. 1901).

‡ See Hollick, Bull. N. Y. Bot. Gard. 2: 381–407. 1902; Blankinship, Rhodora 5: 128, 129, 133. 1903. I have found most of them also in Worcester Co., Mass., and some of the most abundant species extend at least as far up as northern New Hampshire, according to Chittenden (U. S. Forestry Bull. 55: 69, 99. 1905).

the "jack-pine plains" of Michigan (though those are characterized by a different species of pine), according to Spalding * and Beal, † and many of the swamp plants or their near relatives are reported from the same general regions. ‡

Several of the characteristic dry pine-barren plants have been reported by Dr. Britton § from the mountains near the boundary between New York and New Jersey. Much the same flora, and essentially the same types of vegetation, are characteristic of at least some parts of the pine-barrens of New Jersey, judging from the excellent illustrations and descriptions by Hollick, Pinchot, and Gifford in the report on forests which accompanied the report of the state geologist of New Jersey for 1899.‖ Farther south about half the species, or in some cases closely related forms, follow the coastal plain all the way to Florida, while a good many others are found in the South only in the mountains, where they grow on sunny slopes or in sandy bogs. Of the last-mentioned category are *Pinus rigida*, *Quercus ilicifolia*, *Q. prinoides*, *Comptonia*, *Populus*, *Gaultheria*, *Chamaedaphne*, *Kalmia angustifolia*, *Spiraea*, *Carex stricta*, *Lysimachia*, and *Lilium*.¶ The remainder are mostly of pretty wide distribution in temperate eastern North America.

About the time of the Glacial period, when the coastal plain is supposed to have been all under water, all these species must have been confined to the mountains and foothills between Pennsylvania and Alabama. When the glaciated region and coastal plain were again laid bare by the retreating ice and water these plants and their associates were doubtless among the first to take possession of the new territory. Their present rather disjointed

* Am. Nat. 17: 249–259. 1883.

† Mich. Flora 16, 17. 1904.

‡ See Transeau, Bot. Gaz. 36: 403, 404. 1903; 40: 431–446. 1905.

§ Bull. Torrey Club 10: 105. 1883; 11: 126–128. 1884; 14: 187–189. 1887. See also Harshberger, Proc. Acad. Nat. Sci. Phila. 56: 606–609. 1904; Rep. 8th Int. Geog. Cong. 604, 605. 1905.

‖ See also Lighthipe, Torreya 3: 79–81. 1903.

¶ For notes on the occurrence of some of these in the southern mountains see Ashe, Bull. N. C. Geol. Surv. 6: 213, etc. 1898; Small, Torreya 1: 7, 8. 1901; Ashe & Ayres, Pres. Message So. Appalach. Region 93–109. 1902; Harshberger, Bot. Gaz. 36: 379. 1903.

distribution has probably come about chiefly through the subsequent slow but sure encroachments of climax vegetation, on all the better soils.

College Point, L. I.

A TRIP TO JAMAICA IN SUMMER

By Elizabeth G. Britton

Starting for Jamaica on the twenty-fourth of August, after ten weeks of hot, dry weather in New York, does not seem to be an ideal way of spending a vacation; but the voyage there and back on the fine large steamships of the Royal Mail and three weeks in the open air collecting were a welcome and beneficial experience. Wakened at dawn by the rockets signalling for a pilot, it was a beautiful sight to see those glorious Blue Mountains loom dark and mysterious with the comet faintly visible above them, and to watch the change of colors on the water and hills as each familiar land-mark came into view. Since our last visit, the earthquake had laid Kingston in ruins; the cocoanuts at the end of the Port Royal peninsula stood in twenty feet of water and the wrecked steamships of the Hamburg-American line lay on the beach with their tragic history still unfinished. But as we neared our dock, it was but a step "from the sublime to the ridiculous," for there were those same negro boys diving for pennies, exactly as if nothing had happened. Kingston never was a picturesque city and it compared unfavorably with the capitals of any of the larger West Indian Islands; but it has now the dignity of sorrow and the hope of renovation. Many of the business streets are still a mass of tangled ruins, for the new shops are being built on vacant lots away from the water front. We found the trolleys and railroads running as usual and comfortable accommodations at the Constant Spring Hotel. We spent the day after our arrival at the Hope Botanical Gardens, where the blossoms of the *Poinciana* sprinkled the ground with red and the humming-birds darted in and out of the arbors of *Thunbergia grandiflora;* and we left by rail for Williamsfield early the following morning, reaching there in time to drive to Mandeville and

FIGURE 1. *Sabal umbraculifera* near Malvern, Jamaica.

do some collecting. Mandeville lies at an elevation of about 1,800 feet in a hilly region and is much frequented by tourists. There are several good hotels and many fine drives, as well as a

cool and comfortable climate. Wooded hills afford good collecting, and even the roadsides yield interesting species of orchids, bromeliads, mistletoes, and ferns.

But our destination was the Santa Cruz Mountains, where Purdie collected in 1843-44, in order to search for several long-lost species, so we secured a driver and carriage at Mandeville and the following afternoon reached Malvern Hill, where we were joined by Mr. Fawcett and Mr. Harris, whose kind assistance did much to make our trip successful. There is a land-mark on Malvern Hill, a palm eighty feet high, *Sabal umbraculifera*, with swallows darting around its crown of leaves and epiphytes growing on its trunk. All around are pimento trees, the berries of which were ripe, and the fragrance of allspice, drying on the barbecues, scented the air. We spent ten days here very comfortably, making trips both north and south along the ridge at elevations of 2,100-2,700 feet. At Potsdam there is a large school for boys with a private bit of natural woodland, where was found a very rare tree, *Peltostigma ptelioides*, and the star-shaped seedlings of one of the mistletoes, probably *Psittacanthus polyceps*. At Stanmore Hill was found another rare tree, seventy-two feet high, *Spathelia glabrescens*, recalling the "Pride of the Valley," *S. simplex*, which we had seen last year for the first time near Gordon Town. The stem in both species is slender and unbranched, with a crown of long pinnate leaves and a large panicle of brilliant pink flowers at the summit. One trip was made to the southeastern end of the ridge at Yardley Chase, where there is a magnificent view of the ocean from an elevation of 1,600 feet, at one point known as "Lover's Leap." The proprietor, Mr. Panton Forbes, offered us the use of his seaside cottage at Great Pedro Bay, where Dr. Britton and Mr. Harris camped out one night in a search for the long-lost cactus, *Mamillaria simplex*. Plenty of the Turk's-cap and several tall branching species of *Cereus* and *Pilocereus* as well as *Opuntia* were found, making a weird growth among the logwoods back of the sand dunes.

Leaving Malvern Hill for Black River, we descended to the sea-coast again and trips were made to the "honey-comb rocks" at Longacre and Luana Points in search of another palm with

prickly petioles recorded by Grisebach as *Copernicia tectorum.* This also was unsuccessful, though plenty of the silver-thatch palm was found at Ackendown. One of the special features of the trip was a drive to Lacovia, where through the courtesy of Mr. H. M. Farquharson fine specimens of a *Nelumbium* with yellow flowers were obtained. It is supposed to be the same as *N. luteum,* our wild yellow lotus of the United States, but its seeds are pointed at both ends, instead of round, and it has been called *N. jamaicense* DC. It was formerly more abundant than it is now, having been reported from several other stations on the island. Two trips also were made by boat up Black River, where several interesting trees and vines were found. The lowlands of this part of the island are filled with morasses and one unusual palm was obtainable only by wading in and sending a boy up for the leaves and fruit.

The last week of our stay was spent at New Market in the hills of Westmoreland, where the climate is more humid, fogs are frequent at night, and the mosses and ferns, in consequence, are more abundant. The road leading to Montego Bay was traversed twice and yielded an interesting epiphytic cactus of the genus *Rhipsalis* and one of the Gesneriaceae. Another visit during the winter would give a still richer harvest as the rainy season was beginning when we were there, making collecting and drying of plants a difficult matter. The region around Bluefields, also, where Gosse collected so many of the birds of Jamaica would repay further exploration.

We had intended to spend a week at the eastern end of the island, but having read Inspector Thomas's account of it in "Untrodden Jamaica" and learning from the government engineers that it rains three hundred days of the year and the other sixty-five it pours in the John Crow Mountains, which are known as the "Watering Pot of Jamaica," we concluded that it would be better to postpone our trip to them till we were specially prepared and await a more favorable season.

Altogether about 2,000 specimens were secured for the New York Botanical Garden.

New York Botanical Garden.

THE PINE-BARREN BELLWORT

By Kenneth K. Mackenzie

One of the least known of the many peculiar plants found in the pine-barrens of New Jersey is the pretty little bellwort described by Dr. Britton in 1889 (Trans. N. Y. Acad. Sci. **9**: 13) as *Oakesia sessilifolia* var. (?) *nitida*. Since its original collection at Tom's River and Cedar Bridge, it has also been found at Forked River, Lakewood, and Egg Harbor, all within thirty miles of the type station. In addition to its limited range, one reason for the lack of specimens of this species in collections probably is that at the time of its flowering in May the pine-barrens are poor collecting grounds and little explored.

Since its first description this plant has been referred by the late Rev. Thomas Morong (Mem. Torrey Club **5**: 111), together with other forms of *Oakesia*, to *Uvularia* as *Uvularia sessilifolia nitida*, and under this name it appears in the Illustrated Flora (**1**: 409). It is in this last-named work, too, where we first find a hint as to the true relationship of this bellwort, when we are told that it is "perhaps referable to the following species" (*Uvularia puberula* Michx.); and it is to emphasize the close relationship existing between this mountain bellwort (*U. puberula*) and our pine-barren plant that the present paper is written.

	U. sessilifolia	*U. nitida*	*U. puberula*
Capsule	Noticeably stipitate	Sessile, 17 mm. long	Sessile, 24 mm. long
Style	Slender, much exceeding the anthers	Slender, much exceeding the anthers	Thick, little exceeding the anthers
Leaves	Sessile, glaucous beneath, thin, not strongly reticulate-veined; margins entire or minutely serrulate	Subcordate, very green on both sides, thinnish, not strongly reticulate-veined; margins minutely serrulate	Subcordate, very green on both sides, thick, strongly reticulate-veined; margins serrulate
Stem angles	Essentially smooth	Essentially smooth	Serrulate and puberulent

During the last collecting season I had the good fortune to collect the pine-barren bellwort at Tom's River, not only in flower, but also later on in good fruiting condition. A study of this material and all other available collections has convinced me

that in the pine-barren bellwort we have a distinct species, which should be called **Uvularia nitida,** and which is much more closely related to *U. puberula* than it is to *U. sessilifolia.* The preceding table will show the chief differences between the three species.

From the above it may be noted that the differences between *U. nitida* and *U. sessilifolia* are very pronounced, while those between *U. nitida* and *U. puberula* are much more slight. This last-named species is variable, and incomplete specimens from the South, in the Columbia University herbarium, show a close approach to *U. nitida.* The species, however, as a rule, seem decidedly distinct, when represented by good specimens. The style character is apparently especially constant, although it may depend to some extent on the age of the flowers. As between *U. sessilifolia* and *U. puberula* this distinction is well shown in the Illustrated Flora (*figs. 988, 989*).

NEW YORK CITY.

A KEY TO THE WHITE AND BRIGHT-COLORED SESSILE POLYPOREAE OF TEMPERATE NORTH AMERICA — I

BY WILLIAM A. MURRILL

KEY TO THE GENERA

Context white.
- Tubes hexagonal, arranged in radiating rows, context thin. — A. HEXAGONA
- Tubes mostly shallow, marginal and obsolete, hymenium hydnoid or irpiciform at a very early stage. — B. IRPICIPORUS
- Tubes normally poroid, sometimes irpiciform from the rupture of the dissepiments at maturity.
  - Hymenium at length separating very smoothly from the context. — C. PIPTOPORUS
  - Hymenium not separating as above.
    - Pileus very soft, spongy and elastic throughout. — D. SPONGIPORUS
    - Pileus more or less firm, flexible or rigid.
      - Context duplex, spongy above, firm below, surface sodden and bibulous. — E. SPONGIPELLIS
      - Context not duplex as above.
        - Pileus fleshy-tough to woody and rigid.
          - Surface anoderm, rarely zonate.
            - Hymenium more or less smoke-colored at maturity. — F. BJERKANDERA

Hymenium white or pallid.
Context fleshy to fleshy-tough, friable when dry. G. TYROMYCES
Context punky to corky, not friable when dry. H. TRAMETES
Surface pelliculose, zonate. I. RIGIDOPORUS
Pileus thin, leathery and more or less flexible, surface usually zonate.
Hymenophore preceded by a cup-shaped body. J. PORONIDULUS
Hymenophore not as above.
Hymenophore normally pileate, tubes small and regular. K. CORIOLUS
Hymenophore semi-resupinate, tubes large and irregular. L. CORIOLELLUS
Context bright-colored; some shade of yellow or red.
Pores red.
Context soft and spongy. M. AURANTIPORELLUS
Context firm.
Tubes unchanged on drying.
Tubes fragile, surface anoderm. N. PYCNOPORELLUS
Tubes firm and regular, surface pelliculose. O. PYCNOPORUS
Tubes orange-colored, becoming dark and resinous on drying. P. AURANTIPORUS
Pores yellow. Q. LAETIPORUS

A. THE SESSILE SPECIES OF HEXAGONA

1. Tubes unequally hexagonal, the radial walls longer. 2
Tubes equally hexagonal. *H. cucullata* (Mont.) Murrill
2. Tubes large; surface of pileus decorated with imbricated reddish-brown fibrils, which disappear with age. *H. alveolaris* (DC.) Murrill
Tubes much smaller, the mouths rarely over 1 mm. long and 0.5 mm. broad; surface of pileus glabrous. *H. striatula* (E. & E.) Murrill

B. THE SPECIES OF IRPICIPORUS

1. Teeth 1 cm. or more long, pileus usually large and thick. *I. mollis* (B. & C.) Murrill
Teeth less than 0.5 cm. long; pileus thin and shortly reflexed. *I. lacteus* (Fr.) Murrill

C. THE SPECIES OF PIPTOPORUS

Pileus compressed-ungulate, surface smooth, context thick, milk-white. *P. suberosus* (L.) Murrill

D. THE SPECIES OF SPONGIPORUS

Pileus 6–10 cm. broad, surface tomentose to glabrous, tubes large, lacerate. *S. leucospongia* (Cooke & Hark.) Murrill

E. The Species of Spongipellis

1. Pileus more than 1 cm. thick, usually large.	2
Pileus less than 1 cm. thick, small or medium.	*S. galactinus* (Berk.) Pat.
2. Tubes white or slightly discolored.	3
Tubes becoming very dark-colored and resinous.	*S. fissilis* (B. & C.) Murrill
3. Margin of pileus thick and rounded.	4
Margin of pileus thin, not rounded.	5
4. Tubes large, 1 mm. or more across.	*S. unicolor* (Schw.) Murrill
Tubes much smaller.	*S. occidentalis* Murrill
5. Surface conspicuously hairy.	*S. borealis* (Fr.) Pat.
Surface nearly glabrous.	*S. delectans* (Peck) Murrill

F. The Species of Bjerkandera

1. Hymenium smoke-colored when young, soon becoming black.	*B. adusta* (Willd.) Karst.
Hymenium pallid when very young, becoming blackish with age.	2
2. Tubes round, equal and rather thick-walled at maturity; plant not fragrant.	*B. fumosa* (Pers.) Karst.
Tubes angular, unequal, thin-walled and lacerate at maturity; plant fragrant.	*B. puberula* (B. & C.) Murrill

New York Botanical Garden.

SHORTER NOTES

Gymnadeniopsis nivea in Southern New Jersey.— While botanizing near Bennett, Cape May Co., N. J., July 24, 1907, in company with Mr. S. S. Van Pelt, I found a number of orchids growing in a very wet bog. While these were as yet only in early bud, I took them to be *Gymnadeniopsis nivea* on account of the slenderness of the leaves and the appearance of the old flower stalks, a few of which were still standing. Later trips to the spot by Mr. Van Pelt and others proved the correctness of my identification, so that I am now able to add this interesting species to the flora of New Jersey. On August 13 and September 4, it was in full bloom and was found also in several adjoining bogs. Another plant that occurred with it, unquestionably native, is *Boltonia asteroides*, heretofore known only as an introduced species in New Jersey.

Bayard Long.

Ashbourne, Pa.

Rynchospora rariflora in Southern New Jersey.— While visiting the station of *Gymnadeniopsis nivea* described by Mr. Bayard Long, on August 4, 1907, I discovered a patch of

Rynchospora which I failed to recognize and which proved to be *R. rariflora*, a species not previously reported from north of North Carolina, so far as I can ascertain. This adds one more to the list of southern plants that have recently been brought to light in the southwestern portion of the Cape May peninsula.

WITMER STONE.

ACADEMY OF NATURAL SCIENCES,
PHILADELPHIA, PA.

REVIEWS

Kellogg's Darwinism To-Day.*

This timely and welcome volume is intended "as a means of orientation in evolutionary matters for the general reader and for the unspecialized but interested student of science." The controversies instigated by the publication, in 1859, of Darwin's Origin of Species, have undoubtedly won complete victory, at least among scientists, for the theory of evolution; but strange as it may seem, these same controversies and the underlying investigations instigated by Darwin's work, have not resulted in establishing the validity of the particular method of evolution elaborated in the Origin. Quite to the contrary, as Kellogg says, "The fair truth is that the Darwinian selection theories, considered with regard to their claimed capacity to be an independently sufficient mechanical explanation of descent, stand to-day seriously discredited in the biological world." While several alternative and supplementary theories have been advanced, none of them has met with anything like a general acceptation, and Professor Kellogg well expresses our present *statu quo* when he says, "we are immensely unsettled."

In addition to winning the battle for evolution, by whatever method, the above-mentioned controversy has taught us the fundamental lesson that the question of method can never be settled by polemics, nor can the true process, or processes, ever be discovered in library or cloister, nor evolved out of our own inner consciousness. The recognition of this is a great step forward. The true method, or methods, of organic evolution

* Kellogg, Vernon L. Darwinism To-Day. Pp. xii + 403. Henry Holt & Co. New York. 1907.

can be ascertained only by observation and comparison of facts, the framing of hypotheses based upon those facts, and the deductive test of the hypotheses. Thus by a selection of hypotheses the fittest will survive. If Darwinism stands to-day seriously discredited as a sufficient causo-mechanical explanation of the fact of organic evolution, it is not on *a priori* grounds, nor because it is, as supposed by some, atheistic or at variance with the book of Genesis, but solely because, during the fifty years of its rigorous testing by application to fact, it has been found inadequate to explain all of the facts observed.

Not the least value of Professor Kellogg's book is its candid and, so far as space has permitted, adequate statement of both sides of the question, and of the other theories now struggling for recognition. Especially has the author rendered a service in putting Plate's arguments against natural selection into a form readily accessible to those who read German with difficulty, for Plate's work constitutes one of the strongest assaults against the Darwinian citadel.

On page 234, when the author says, "If, in a species, a number of individuals show a certain congenital variation, this variation will probably be lost by cross-breeding with individuals not having it, unless the individuals having it are in the majority or unless they become in some way isolated from the others so that they will breed among themselves," we are not sure from the context whether he is stating his own belief or merely the argument of the isolationists. In any event, there seems to be here a disregard of Mendelian light; and a treatment of the bearing of Mendelism on swamping by cross-breeding is not met with elsewhere in the book.

On page 330 the assertion, "Species-forming by sports and discontinuous variations is obviously (*sic*) no theory to presume to offer itself as a species-forming substitute for natural selection," seems strikingly intemperate in comparison with the treatment of other theories in the book. Not "obviously," by any means; and least so to those who have taken the pains to check up the results of field studies by experiments with pedigreed cultures. On page 377 the mutation-theory of de Vries seems to

the reviewer to be entirely misrepresented when it is said to "offer itself as an .explanation of adaptation," and to be a "claimant for recognition as the great cause of descent." Unless I have entirely misunderstood de Vries, mutation was never put forward by him as an explanation of adaptation, nor as a "cause" of anything, but as a method only; the method of variation (by saltation) whose results are held most probably to furnish the material for natural selection (the great "sieve," as de Vries calls it) to act on. Adaptation, for the de Vriesian mutationist, as well as for the Darwinian, results from the survival of the fittest (because best adapted) in the struggle for existence. It were much nearer the truth to say that mutation offers an explanation for the lack of adaptation, *i. e.*, for the origin of characters that are not adaptive. It is on this point that the weakness of natural selection is greatly in evidence.

The last chapter is a kind of confession of faith, or scientific creed, of the author, in which he makes it more clear, if possible, than do the above quotations, that he is not a mutationist. "Darwinism," he says, "as the natural selection of the fit, the final arbiter in descent control, stands unscathed, clear and high above the obscuring cloud of battle. At least, so it seems to me. But Darwinism, as the all-sufficient or even the most important causo-mechanical factor in species-forming and hence as the sufficient explanation of descent, is discredited and cast down." The author urges us, "with Osborn," to "join the believers in the 'unknown factors in evolution,'" and inclines to a belief that there is "an automatic modifying principle which results in purposive change, that is, in the change needed as the indispensable basis for the upbuilding of the great fabric of species diversity and descent" (p. 387).

The reading of the book is rendered easier and more pleasant by the paragraph headings in heavy type, and less so by numerous lengthy quotations in German and French in the appendices to the chapters. The citations to original papers serve to render the book even more helpful and indispensable. All students of evolution-theories and kindred problems will warmly welcome it.

C. STUART GAGER.

PROCEEDINGS OF THE CLUB

November 27, 1907

The meeting was called to order at the museum building of the New York Botanical Garden at 3:45 P. M. by the secretary, and Dr. N. L. Britton was elected chairman. Nineteen persons were present. After the reading and approval of the minutes of the preceding meeting, the name of Mr. Edward N. E. Klein, College Point, L. I., was presented for membership.

The chairman made formal reference to the death of Professor Underwood, vice-president of the Club, and a motion was made and carried that a committee of three be appointed by the chair to draw up suitable resolutions, and arrange for a memorial program of the Club, to be given as soon as the arrangements for it can be perfected. The following were appointed as members of the committee: Dr. C. C. Curtis, Dr. John Hendley Barnhart, and Dr. M. A. Howe.

A communication was read from the secretary of the New York Academy of Sciences, calling attention to the fact that, by the death of Professor Underwood, the Club is now without a representative on the Council of the Academy. Mr. Charles F. Cox was nominated to fill this vacancy, and was unanimously elected.

The matter of distribution of pay for clerical assistance for the treasurer came up for discussion, and, by unanimous vote of the Club, the treasurer was authorized to pay fifteen dollars a quarter for such purpose.

A request was presented from Mr. Stewardson Brown for a grant of $200 from the Esther Herrman Research Fund of the New York Academy of Sciences for aid in completing an investigation of the flora of Bermuda and its origin. This request was approved by the unanimous vote of the Club.

The resignation of Miss Mary E. Davidson was read and accepted.

On vote of the Club the secretary cast the vote of the members electing Mr. Klein to membership.

Mr. G. V. Nash exhibited a flowering specimen of the orchid *Masdevallia bella*.

The Rev. Leander T. Chamberlain read an extract copied from the Province Laws of Massachusetts, 1736–1761, p. 153, entitled "An Act to Prevent Damage to English Grain, Arising from Barberry Bushes." All persons in the province having barberry-bushes growing on their land, were ordered to destroy them before a named date. Severe penalties were described for failure to comply with this law. A brief discussion of the subject followed. The act is here printed in full:

An Act to Prevent Damage to English Grain, Arising from Barberry Bushes

Whereas it has been found, by experience, that the blasting of wheat and other English grain, is often occasioned by Barberry Bushes, to the great loss and damage of the inhabitants of this Province,

Be it therefore enacted by the Governour, Council, and House of Representatives,

That whoever, whether community or private person, hath any Barberry Bushes, standing or growing in his or their land within any of the towns in this province, he or they shall cause the same to be extirpated or destroyed on or before the tenth day of June, Anno Domini one thousand seven hundred and sixty.

Be it further enacted,

That if there shall be any Barberry Bushes standing or growing, in any land within this Province, after the said tenth day of June, it shall be lawful, by virtue of this act, for any person whomsoever, to enter the lands wherein such Barberry Bushes are, first giving three months' notice of his intention so to do, to the owner or occupant thereof, and to cut them down, or pull them up by the roots, and then to present a fair account of his labour and charge therein to the owner or occupant of the said land; and if such owner or occupant shall neglect or refuse, by the space of two months next after the presenting said account, to make to such person reasonable payment as aforesaid, then the person who cut down or pulled up such bushes, may bring his action against such owner or occupant, owners or occupants, before any Justice of the Peace, if under forty shillings; or otherwise, before the Inferior Court of Common Pleas in the County where such bushes grew; who, upon proof of the cutting down or pulling up of such bushes, by the person who brings the action, or such as were employed by him, shall and is hereby, respectively, empowered to enter up judgment for him to recover double the value of the reasonable expense and labour in such service, and award execution accordingly.

Be it further enacted,

That if the lands on which such Barberry Bushes grow are common and undivided lands, that then an action may be brought, as aforesaid, against any one of the proprietors, in such manner as the laws of this Province provide in such cases where proprietors may be sued.

Be it further enacted,

That the Surveyors of the Highways, whether publick or private, be and hereby are empowered and required, ex officio, to destroy and extirpate all such Barberry Bushes as are or shall be in the highways in their respective wards or districts; and if any such shall remain after the aforesaid tenth day of June, Anno Domini one

thousand seven hundred and sixty, that then the town or district in which such bushes are, shall pay a fine of two shillings for every bush standing or growing in such highway, to be recovered by Bill, Plaint, Information, or the Presentment of a Grand Jury, and to be paid, one half to the informer, and the other half to the Treasurer of the County in which such bushes grew, for the use of the County.

Be it further enacted,

That if any Barberry Bushes stand or grow in any stone wall, or other fence, either fronting the highway, or dividing between one propriety and another, that then an action may be brought, as aforesaid, against the owner of said fence, or the person occupying the land to which such fence belongs; and if the fence in which such bushes grow is a divisional fence between the lands of one person or community and another, and such fence hath not been divided, by which means the particular share of each person or community is not known, then an action may be brought, as aforesaid, against either of the owners or occupants of said land.

Be it further enacted,

That where the occupant of any land shall eradicate and destroy any Barberry Bushes growing therein, or in any of the fences belonging to the same (which such occupant is hereby authorized to do, and every action to be brought against him for so doing shall be utterly barred), or shall be obliged, pursuant to this act, to pay for pulling them up or cutting them down, that then the owner or proprietor of such land shall pay the said occupant the full value of his labour and cost in destroying them himself, or what he is obliged to pay to others as aforesaid; and if the said owner or owners shall refuse so to do, then it shall be lawful for said occupant or occupants to withold so much of the rents or income of said land as shall be sufficient to pay or reimburse his cost and charge arising as aforesaid.

This act to continue and be in force until the tenth day of June, one thousand seven hundred and sixty-four.

[An Early Massachusetts Statute for the Prevention of Wheat-Rust. *Anno Regni Regis Georgii II, Vicesimo Octavo,* Chap. X. (published January 13, 1755).]

Dr. Britton exhibited a specimen from Jamaica, W. I., illustrating an economic use of cat-tails. This was a "bed," made from the split stems of *Typha domingensis.*

The following scientific program was presented:

"A new *Utricularia* from Long Island," by John Hendley Barnhart.

The new species was described and specimens of it exhibited. The paper and description will be published in full in the *Bulletin* of the Torrey Botanical Club, for December, 1907.

"Some anomalous Leaf-Forms," by C. Stuart Gager.

Specimens were shown illustrating the formation of ascidia in the white (?) clover and in a leaflet of the licorice (*Glycyrrhiza*); variations in the branching of the leaf-blade of a species of *Fraxinus;* transitions in *Aralia racemosa,* from a once-compound to a

normally twice-compound leaf; branching of the leaflets of *Hicoria ovata* and of *Aesculus Hippocastanum*; and various stages of transition, in *Gleditsia triacanthos*, from once-compound leaves to twice- and thrice-compound ones, the transitional forms occurring in some instances on the same branch, and even on the same leaf. Rosette leaves were also shown from several species of Biotian asters, showing gradual transitions from a slight indentation of the margin of the blade along its basal half to the development of petiolate leaflets, so that the leaf appeared to be a pinnately compound one. The possible causes of these variations were briefly discussed.

Brief discussion followed the presentation of both papers.

The Club adjourned at 5:30 o'clock.

C. Stuart Gager,
Secretary.

NEWS ITEMS

Dr. B. M. Duggar has resigned the professorship of botany in the University of Missouri to accept a professorship in Cornell University.

Mr. R. S. Williams, assistant curator of the New York Botanical Garden, left New York for Colon on January 25, expecting to devote several months to making botanical collections in the Republic of Panama.

Mr. George E. Davenport, well known as a student of the North American ferns, died in Medford, Massachusetts, November 29, 1907. He had completed his seventy-fourth year on August 3, preceding.

Mr. Harlan H. York is in charge of the botanical work at the University of Texas, pending the appointment of a professor of botany to succeed Dr. William L. Bray, now of Syracuse University.

Dr. Burton E. Livingston, of the department of botanical research of the Carnegie Institution, has been granted a year's leave of absence, which he will devote to study in European laboratories. He sailed from Boston for Naples on January 11.

Dr. C. B. Robinson, whose appointment as economic botanist of the Bureau of Science of the Government of the Philippine Islands was noted in TORREYA for October, left New York January 21 on his westward journey to the Orient. He plans to sail from San Francisco January 30 on the *Mongolia* for Yokohama and Hong Kong.

Dr. Marshall A. Howe and Mr. Percy Wilson, of the staff of the New York Botanical Garden, returned on January 5 from a collecting cruise of about six weeks duration among the eastern and southeastern islands of the Bahamian group. Visits were made to Watling Island, Atwood (Samana) Cay, Mariguana, the Caicos Islands, Little Inagua, and Great Ragged Island.

The American Association for the Advancement of Science held its fifty-eighth meeting at the University of Chicago, December 30, 1907, to January 4, 1908. The sessions of Section G (botany) were presided over by Professor Charles E. Bessey. The subject of the address of the retiring chairman, Dr. D. T. MacDougal, before Section G, was "Heredity and Environic Forces." Professor Herbert M. Richards was elected chairman of the Section (and vice-president of the Association) for the next meeting, and Dr. Henry C. Cowles was elected secretary of the Section for a term of five years.

The fourteenth annual meeting of the Botanical Society of America was held at the University of Chicago, December 31, 1907, to January 3, 1908, under the presidency of Professor George F. Atkinson. The program included an interesting symposium on "Aspects of the Species Question," the taxonomic aspect being discussed by C. E. Bessey and N. L. Britton, the physiologic by J. C. Arthur and D. T. MacDougal, and the ecologic by F. E. Clements and H. C. Cowles. In addition, twenty-six papers, giving the results of a wide range of botanical research were presented. The retiring president, Professor F. S. Earle was absent, and his announced address on "Botanical Problems and Opportunities" was not read. Officers were elected as follows: Professor William F. Ganong, president; Mr. C. L. Shear, vice-president; Professor D. S. Johnson, secretary; Dr. Arthur Hollick, treasurer.

TORREYA

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SOME EFFECTS OF FROST IN THE SOUTHWEST

BY J. C. BLUMER

To what extent a severe spring frost in the southwest may injure forest growth is shown by a series of interesting observations by Mr. Frank J. Phillips.* The fact that a large number of tree species in the Chiricahua Mountains of Arizona failed to bear fruit in the autumn of 1907, may have been due to the same cold wave that defoliated the young trees in certain parts of the New Mexican mountains. In 1906 many of these species fruited abundantly notwithstanding the fact that this was a drier season than 1907. It is possible that the general backwardness of the latter season also may have had something to do with it. The pines, however, are known to be intermittent in their seed-bearing habits. The following is a list of Chiricahua species with the seed crops of 1906 and 1907 compared. In many cases the same individuals were observed both years:

	1906	1907
Walnut (*Juglans rupestris*)	An abundant crop of nuts	Not a single nut found
Sycamore (*Platanus Wrightii*)	Balls plentiful	No balls apparent
Cherry (*Prunus salicifolia*)	A good crop of wild cherries	Not a single cherry seen
Box elder (*Acer Negundo*)	A limited crop of samaras	No samaras found
Ash (*Fraxinus* sp.)	Trees loaded with fruit	Crop small or absent
Cascara (*Rhamnus* sp.)	Fruiting abundantly	No fruit observed
Grape (*Vitis* sp.)	A large crop	A small crop
Oaks, seven species observed	Acorns common to abundant	Acorns absent or few †
Arizona pine (*Pinus arizonica*)	Good crop, many trees loaded with cones	Crop very poor, one might travel half a day to find one cone

* Forestry and Irrigation, September, 1907.

† One or two species, however, ranging below 5,000 feet altitude, bore an abundant crop. With exception of these and the ash, none of the species named descends to this level within the region observed.

[No. 2, Vol. 8, of TORREYA, comprising pages 1–24, was issued January 27, 1908.]

Mexican white pine (*P. strobiformis*)	Many trees conspicuously filled	No cones apparent
Douglas fir (*Pseudotsuga taxifolia*)	Cones very abundant	Cones scarce
White fir (*Abies concolor*)	No cones found in either year	

In the fall of 1906, the first two severe frosts occurred in the aforesaid mountains on the nights of October 22 and 23. Practically all the herbaceous plants were killed to the ground. A few days later the deciduous tree species along Riggs Creek were examined. *Juglans rupestris*, *Fraxinus*, and *Vitis* had all their leaves killed, proving to be the ones most easily injured. *Schmaltzia* was almost killed in this open canyon, yet in the narrow Bonita Canyon near by, which has high, perpendicular walls, this genus was collected a week later, remarkably preserved. Certain acacias behaved likewise. Sycamore did not suffer greatly, but the least harm came to the willow and the cherry. The leaves of the latter hang on the tree till very late in autumn, hardly losing their green color before they fall. Of all the deciduous arboreal species of this region, this approaches most nearly the evergreen habit. Thus it is possibly relatively frost-hardy for the same reasons as the very frost-resistant as well as drouth-defiant evergreens, such as the oaks. On the whole it appeared that the species which lived upon the least moisture were also the most frost-hardy.

On the other hand, as is well known, the presence of an abundance of water has often a powerfully protective effect. The snowberry (*Symphoricarpus*), growing at an altitude of 8,000 feet, had its leaves nearly killed where growing in the open, severely bitten where standing under trees, damaged but little where growing without a canopy but on springy soil, and escaped without any harm whatever where it stood under the spreading boughs of the white fir while the water trickled about its roots.

Other shrubby genera occurring in this place are *Opulaster*, *Holodiscus*, *Rubus*, *Salix*, and *Ptelea*, but *Symphoricarpus* appears to be the hardiest of all.

DESERT BOTANICAL LABORATORY,
TUCSON, ARIZONA.

THE WHITE CEDAR IN WESTERN LONG ISLAND

By Eugene P. Bicknell

The article by Dr. R. M. Harper in Torreya (7: 198–200. O 1907), entitled "A Long Island Cedar Swamp," makes appropriate some further reference to the southern white cedar, *Chamaecyparis thyoides* (L.) B. S. P., in western Long Island.

In this region the white cedar is one of the rarer trees and is known to me from only three localities, all on the south side of the island. It occurs near Merrick, in Rockville Center, at a point nearly six miles to the west, and again directly west, eight and a half miles between Jamaica South and Aqueduct, this station being within the corporate limits of Greater New York and not ten miles from the Brooklyn Borough Hall.

The locality near Merrick is the cedar swamp described by Dr. Harper and earlier mentioned by Mr. J. T. Nichols in *Rhodora* (9: 74. Ap 1907). In the interest of a clear record it should be said that this cedar swamp is the same one to which an excursion of the Torrey Club was conducted by Miss F. A. Mulford on May 30, 1906. Upon that occasion the swamp was explored at a point over half a mile north of the railroad. Dr. Harper traced the cedars several hundred yards south of the railroad. Hence it appears that the growth extends nearly a mile north and south along the stream. Probably no more extensive growth of this tree occurs within a much greater distance from New York.

A colony some eight miles further to the east, just west of Amityville, is also reported by Mr. Nichols (*loc. cit.*).

At Rockville Center two good-sized trees grow near together in the swampy thicket along the brook flowing from Hempstead Pond.

The westernmost station, a mile and a quarter east of Aqueduct, is a swampy spot in the woods which, though it now becomes dry in summer, was once evidently a more permanent swamp and formed the source of a small brook. Here is an assemblage of white cedars not more than a few rods in extent, the remnant of an ancient colony as attested by the size of some of the trees. When last visited, May 9, 1906, many of the trees were dead or

dying, the most vital appearing green in their upper parts only. The largest trunk measured 7 feet 6 inches in circumference close to the base and 6 feet 9 inches a foot above the ground.

Of the localities mentioned by Torrey (1842) that at Hempstead is probably now reduced to the two companion trees at Rockville Center on the stream flowing south from Hempstead, which was dammed and excavated over thirty years ago, I am told, to form the Hempstead reservoir and associated ponds.

Wherever Torrey's Rockaway station may have been, there can be little doubt that it no longer exists.

NEW YORK, December, 1907.

A KEY TO THE WHITE AND BRIGHT-COLORED SESSILE POLYPOREAE OF TEMPERATE NORTH AMERICA.—II

BY WILLIAM A. MURRILL

G. THE SPECIES OF TYROMYCES

1.	Pileus large, 8 cm. or more in diameter.	2
	Pileus small, 5 cm. or less in diameter.	6
2.	Tubes less than 5 mm. long.	3
	Tubes more than 5 mm. long.	5
3.	Surface of pileus marked with circular depressed spots.	*T. guttulatus* (Peck) Murrill
	Surface of pileus not guttulate.	4
4.	Pileus over 1 cm. thick.	*T. palustris* (B. & C.) Murrill
	Pileus less than 5 mm. thick.	*T. obductus* (Berk.) Murrill
5.	Pileus very smooth, becoming dark sordid-bay on drying.	*T. Smallii* Murrill
	Pileus rough, sodden, white, becoming blackish, especially at the margin.	*T. Spraguei* (B. & C.) Murrill
	Pileus tuberculose, ochraceous, not becoming blackish.	*T. tiliophila* Murrill
6.	Pileus resinous or cartilaginous in appearance.	7
	Pileus neither resinous nor cartilaginous.	8
7.	Tubes sharply and deeply lacerate.	*T. cerifluus* (B. & C.) Murrill
	Tubes slightly dentate.	*T. semisupinus* (B. & C.) Murrill
8.	Tubes large, irregular, lacerate, 1–2 to a mm.	*T. undosus* (Peck) Murrill
	Tubes much smaller, usually regular and entire.	9
9.	Surface zonate.	10
	Surface azonate.	11
10.	Pileus 1–3 mm. thick, not effused.	*T. crispellus* (Peck) Murrill
	Pileus 5 mm. or more thick, effused-reflexed	*T. Ellisianus* Murrill
11.	Surface conspicuously villose or tomentose.	12
	Surface glabrous or nearly so.	13

12.	Pileus more or less bluish, not effused.	*T. caesius* (Schrad.) Murrill
	Pileus not bluish, effused-reflexed.	*T. semipileatus* (Peck) Murrill
13.	Surface pelliculose, more or less tinged with gray.	*T. chioneus* (Fr.) Karst.
	Surface white, without a pellicle.	14
14.	Pileus about 2 mm. thick.	*T. Bartholomaei* (Peck) Murrill
	Pileus much thicker.	15
15.	Edges of tubes obtuse, entire.	*T. anceps* (Peck) Murrill
	Edges of tubes very thin, lacerate.	*T. lacteus* (Fr.) Murrill

H. The Species of Trametes

1.	Context punky, soft.	2
	Context corky, rather firm.	*T. subnivosa* Murrill
2.	Tubes small, 4 to a mm.; found on *Robinia*.	*T. robiniophila* Murrill
	Tubes large, 2 to a mm.; found on *Salix*.	*T. suaveolens* (L.) Fr.

I. The Species of Rigidoporus

Pileus thin, rigid, multizonate, reddish; tubes rather slender, edges thin. *T. surinamensis* (Miq.) Murrill

J. The Species of Poronidulus

Pileus thin, conchate, white, with pale-reddish zones; found on elm branches. *T. conchifer* (Schw.) Murrill

New York Botanical Garden.

SHORTER NOTES

The Name Chara.—The origin of the modern application of the name *Chara* has been much disputed, and it may not be superfluous to call attention to one opinion, which seems to be the most plausible, and to connect with it the name of the author who appears to have introduced the word into literature, although he attained his eminence in other fields. Julius Caesar in the 48th chapter of the 3d book of his "De Bello Civile" says: Est etiam genus radicis inventum ab iis, qui fuerant in vallibus, quod appellatur *Chara*, quod admixtum lacte multum inopiam levabat. Id ad similitudinem panis efficiebant.

This may be roughly translated: There is also a kind of root, found by those who had been in the valleys, which is called *Chara*, and this when mixed with milk greatly lessened the feeling of hunger. They make it into the likeness of bread.

No person can possibly advance the idea that the *Chara* of modern botany could be made into bread, with or without the use of milk. This merely proves that the name was in use in

Italy nearly 2,000 years ago; and other evidence seems to connect it with some umbelliferous plant, similar to *Carum Carui*, the caraway, a name probably derived from the same source. The rough resemblance of a *Chara* and an umbellifer is very considerable, and the history of the word would seem to be that it arose as a local name for an Italian flowering plant, was in use in this sense for many centuries, and passed into its present acceptance at the moment when it acquired botanical significance.

C. B. Robinson.

New York Botanical Garden.

A Red-Fruited Huckleberry.—When visiting the botanically well-known Bergen Swamp in Genesee County, N. Y., in August, 1907, examples of *Gaylussacia resinosa* (Ait.) T. & G. with red or wine-colored fruit were found. The berries were more juicy than in the common form, about like those of *Vaccinium vacillans* as compared in this quality with the average fruit of *G. resinosa*. The usual form with black fruit, as well as *G. dumosa* (Andr.) T. & G., was also well represented there. The oval or oblong leaves of these red-fruited shrubs were somewhat smaller than is commonly the case, 2–3 cm. × 1–1.5 cm., frequently considerably tinged with red, and more inclined to an acute or acutish apex. The leaves of the black-fruited form from the locality were quite obtuse. The shrubs were in those parts of the swamp called "open," in which there are clumps or small areas of bushes of various kinds, often with one or more trees of stunted white pine or white cedar growing with them. Here the ground flora was of sphagna and other peat-loving mosses and of such herbaceous plants as frequent habitats of this character. The larger part of the open swamp has a marly soil, loosely covered with grasses and sedges, and usually with a thin sheet of water above the marl even in the dry season. The water is clear, and in places had a slow movement in the direction of its outlet to Black Creek. The spots occupied by bushes were raised a little above the general level, being gradually converted into highmoor. In such an environment was a clump, 2 or 3 meters across, of this red-fruited huckleberry, well exposed to the full light and heat of the sun.

White-fruited forms of *G. resinosa* are mentioned in our manuals of botany, and the red may also have been detected before. They are analogous to cases more often occurring in the common blueberries. I have several times come upon *Vaccinium vacillans*, with white or pinkish fruit, in the dune region of northern Indiana. Sometimes the bushes will almost or quite exclusively occupy an area of one or two square rods, producing berries of these abnormal colors which can be gathered by the quart.

E. J. HILL.

CHICAGO, ILL.

REVIEWS

Curtis's Nature and Development of Plants*

In this work the author has "had in mind a purpose to make familiar our common plants," this knowledge being considered fundamental in any botanical work. The volume is not offered as a text, but as a reader to accompany lectures and laboratory work. Pedagogically the object is to "quicken the reasoning faculty, and create a desire for a further examination of the subject."

The Introduction discusses, (1) The Nature of the Plant (as made up of cells); (2) The Nature of the Living Substance of the Plant. The four sections of Part I, Nature of Plants, treat, in order, of the leaf, the root, the stem, and the flower, fruit, and seedling. Part II, The Development of Plants, comprises six sections, dealing with, Classification of Plants, Thallophyta, Bryophyta, Pteridophyta, Spermatophyta, Angiospermae (Spermatophyta concluded). Two hundred and forty-four pages are devoted to Part II, and ninety-four to Part I.

In conformity with the aim, familiarity with common plants, physiology is given less prominence than structure and classification. There are no illustrations of physiological experiments. On reading through the chapters, one's attention is arrested by the use of pistil and carpel as synonymous (p. 102); of antheridial cell for the more usual term generative cell (p. 108); and

* Curtis, Carlton C. Nature and Development of Plants. Pp. vii + 471. *f. 1–342.* Henry Holt & Co., New York. 1907.

of epicotyl and plumule as synonyms (p. 112), though on page 122 the plumule is described as composed of leaves.

The volume is one of the best-illustrated books that has appeared for some time, and the omission of half-tones from the illustrations has obvious advantages. Some of the figures will undoubtedly become classical, and supplant the well-worn ones "made in Germany."

We believe that the author's plan of introducing the student to botany by a study of spermatophytes, with which he is more or less familiar, has much to commend it, both theoretically and practically, over the plan of beginning with unicellular plants. The book will undoubtedly materially assist the pupil in getting the most out of his lectures and laboratory exercises.

C. STUART GAGER.

PROCEEDINGS OF THE CLUB

DECEMBER 10, 1907

The regular meeting of the Club was held at the American Museum of Natural History at 8:30 P. M., with President Rusby in the chair; fourteen persons were present. In the absence of the secretary, Mr. Charles L. Pollard was appointed acting secretary.

The chairman stated, on behalf of the committee appointed to arrange a memorial meeting in honor of Professor Underwood, that the committee had the matter in hand and would be prepared to report at an early date.

A letter was read from Mr. C. F. Cox, elected at the last meeting of the Club to serve as its representative on the Council of the New York Academy of Sciences, in which he stated that owing to the fact of his nomination to the presidency of the Academy it would be advisable for the club to elect another representative in his place. Dr. Marshall A. Howe and Mr. Charles L. Pollard were nominated. The chairman stated that Dr. Howe was absent from the country, and that it was consequently uncertain whether he would be prepared to serve. The nomination of Dr. Howe was then withdrawn and Mr. Pollard was unanimously elected as the representative of the Club on the Council of the Academy.

A letter was read from Professor E. O. Hovey, recording secretary of the Academy, asking the attention of the club to a resolution of the Academy in which the affiliated societies are invited to recommend suitable lectures to be given under the auspices of, and at the expense of the Academy. Dr. Southwick moved that President Rusby be invited, on behalf of the Club, to deliver a lecture under the conditions suggested, and that notice of this be sent to the recording secretary of the Academy. The motion was put by the acting secretary and unanimously adopted. In thanking the Club for the honor Dr. Rusby referred to the interest now displayed in the matter of the purity of commercial drugs in connection with the Pure Food Law, and stated that the proposed lecture, if given, would be upon this topic.

The following scientific program was presented:

"Dictionaries and their Relation to Biology," by Charles Louis Pollard.

The speaker referred to the fact that a large part of the increment in our language in recent years has consisted of scientific terms, including new Latin classificatory names, biological descriptive words and phrases, and vernacular names. In spite of this there is a very general lack of interest among working scientists in the average dictionary, and it is not the indispensable reference book that it should be. The reasons for this are to be sought in the attitude of the publishers toward the style of definitions, the effort to avoid undue technicality often resulting in scientific inaccuracy. Obsolete words and meanings are frequently given too great prominence and are not properly differentiated from those in current usage. There is also a tendency to magnify the importance of so-called popular names, many of which are coined by the writers of manuals and are not used elsewhere.

The general discussion which followed brought out the fact that the dictionary, in spite of its defects, contains much information difficult to obtain from other sources, but that it is very generally at variance with usage among botanists in the matter of pronunciation.

"Notes on the Pine-barrens of Long Island," by Roland M. Harper:

The flora of the pine-barrens of Long Island has received little attention from botanists, chiefly because it consists of comparatively few and widely distributed species. A list of 46 Long Island pine-barren plants was published by Dr. Britton in 1880, and copied by at least three subsequent writers, but even yet the aspects of the vegetation have scarcely been described, or any photographs of it published in botanical literature.

The pine-barrens are confined chiefly to the southern half of Suffolk County, and are very well developed in the uninhabited portions of the towns of Babylon and Islip. The area covered by them is very flat, with a soil of coarse sandy loam. The vegetation is of two types, that of the dry pine-barrens and that of the swamps, the former being by far the most extensive. In the dry pine-barrens the trees are nearly all *Pinus rigida*, and there is a dense undergrowth consisting mostly of *Quercus ilicifolia* and *Q. prinoides*, two to six feet tall. The commonest herbs are *Pteridium aquilinum*, *Ionactis*, *Cracca*, *Baptisia*, *Dasystoma*, etc. The effects of fire are everywhere visible.

In the swamps the flora is somewhat richer than in the dry pine-barrens. *Acer rubrum*, *Nyssa*, *Clethra*, *Alnus*, *Myrica*, *Ilex*, *Osmunda*, and *Dulichium* are characteristic. Ericaceae and allied families are well represented.

Nearly all the species in these pine-barrens are quite widely distributed in the glaciated region, or on the coastal plain, or both. Many also occur in the mountains, from New Jersey to Georgia. The vegetation is very similar to that of some parts of the pine-barrens of New Jersey, from all accounts, but the flora is considerably less diversified.

The paper was illustrated by photographs, and will be published in the January (1908) number of *Torreya*.

The club adjourned at 10 o'clock.

CHARLES LOUIS POLLARD,
Secretary pro tem.

JANUARY 14, 1908

The first stated meeting for 1908 was held at the American Museum of Natural History at 8:15 P. M. Vice-President

Edward S. Burgess occupied the chair. The attendance was fourteen.

After the reading and approval of the minutes for December, 1907, the following names were presented for membership:

Professor William L. Bray, Syracuse University, Syracuse, N. Y.

Mr. Frank Dunn Kern, Agric. Exp. Station, Lafayette, Ind.

This being the annual business meeting of the Club, the chairman called for the reports of officers for 1907. Reports of the secretary, treasurer, editor, and corresponding secretary were read, accepted, and placed on file.

The secretary reported that fourteen regular meetings had been held during the year with a total attendance of 306, as against 219 in 1906, and an average attendance of 21.8, as against 16.8 last year. A total of 37 formal papers was presented before the club, distributed according to subject-matter as follows: taxonomy, 5; physiology, 6; morphology, 4; ecology, 7; regional botany, 5; exploration, 2; lantern lectures, 4; miscellaneous, 4. In addition to these were numerous informal notes and exhibitions of specimens.

The editor reported the publication of one number of the Memoirs, of 47 pages, and the issuance of the *Bulletin* and of *Torreya* as usual. The need of an adequate index to the *Bulletin* from volume one to thirty, inclusive, was strongly emphasized.

On behalf of the committee on the local flora, the chairman, Dr. Britton, urged the need of increased activity, and emphasized the desirability of preparing a special work on the flora of New York City and vicinity. At present no such work exists.

Resignations from membership from Mr. Percy L. Ricker and Miss Bina Seymour were read and accepted.

The secretary was instructed to cast the ballot of the Club electing to active membership the persons proposed as above.

Election of officers for the year 1908 resulted in the election of the following ticket:

President: Henry Hurd Rusby.

Vice-Presidents: Edward Sandford Burgess and John Hendley Barnhart.

Secretary: C. Stuart Gager.

Treasurer: William Mansfield.

Editor: Marshall Avery Howe.

Corresponding secretary: On motion the election of a corresponding secretary was indefinitely postponed.

Associate editors: John Hendley Barnhart, Jean Broadhurst, Philip Dowell, Alexander William Evans, Tracy Elliot Hazen, William Alphonso Murrill, Charles Louis Pollard, and Herbert Maule Richards.

The chairman appointed Dr. Small and Dr. Gager as auditing committee.

After an informal discussion of the personnel of the committees to be appointed for the ensuing year, the club, on motion, adjourned at ten o'clock.

C. Stuart Gager,
Secretary.

NEWS ITEMS

Dr. Raymond H. Pond, who sailed for Europe early in November, is studying in the laboratory of Professor Ludwig Jost in Bonn.

Mr. A. P. Morgan, well known as a collector and student of the fungi, died at his home in Preston, Ohio, on October 19, 1907.

Dr. William A. Murrill, for the past two years first assistant of the staff of the New York Botanical Garden, has been advanced to the rank of assistant director of that institution.

Professor Edward S. Burgess, vice-president of the Torrey Botanical Club, has been acting president of the Normal College of the City of New York since the death of Acting-President Gillet.

Dr. Hermann Graf zu Solms-Laubach, editor of the *Botanische Zeitung*, has retired from the professorship of botany at the University of Strassburg. He will be succeeded by Dr. Ludwig Jost of the Royal Agricultural Academy at Bonn.

Dr. W. A. Kellerman, professor of botany in the Ohio State University, is now on his fourth winter expedition to Guatemala,

accompanied by several student assistants. As on previous visits, he will give special attention to collecting parasitic fungi.

Dr. Anstruther A. Lawson, recently of the department of botany of the Leland Stanford Junior University, passed through New York in December on his way to the University of Glasgow, where he has accepted a position as assistant in botany.

"A Synopsis of the North American Godetias" by Professor Willis Linn Jepson and "Compositae of Southern California" by Mr. Harry Monroe Hall are two important papers of taxonomic interest, which appeared in December in the botanical series of the University of California Publications.

Through the generosity of Mr. Andrew Carnegie, the herbarium of the late Dr. Otto Kuntze of San Remo, Italy, has been purchased for the New York Botanical Garden. This herbarium is estimated to contain over 30,000 specimens, including a considerable number of "types" from South America and other parts of the world visited by Dr. Kuntze during his extensive botanical tours.

Dr. and Mrs. N. L. Britton and Dr. Arthur Hollick of the New York Botanical Garden sailed for Kingston, Jamaica, on February 22. They will be joined at Kingston by Mr. William Harris, superintendent of the Public Gardens and Plantations of Jamaica, and will then make collections at the western end of the island, with the aid of a Bahamian schooner which has been chartered for the purpose. It is expected that a stop will be made at Guantanamo, Cuba, on the return voyage.

No. 6 of the Augustana Library Publications is a Linné Memorial, in which the leading paper is an interesting account of "Scandinavians who have Contributed to the Knowledge of the Flora of North America" by Dr. Per Axel Rydberg. Biographical sketches and bibliographies of 104 Scandinavians and Scandinavian-Americans are included. Pehr Kalm, Carl von Linné, Olof Swartz, Martin Vahl, Elias M. Fries, J. G. Agardh, S. O. Lindberg, Th. M. Fries, J. M. C. Lange, Baron H. F. A. Eggers, William Nylander, Nils Gustaf Lagerheim, F. M. Liebman, A. S. Örsted, N. C. Kindberg, Theodor Holm, Aven Nelson, and P. A. Rydberg, are among the better-known names in the distinguished list.

A notable event in the progress of science and of public education in New York is the bequest of $1,000,000 to the American Museum of Natural History by Morris K. Jesup, who was its president from 1882 to his death on January 22, 1908. The provision in his will relating to the museum reads, in part, as follows:

I give and bequeath to the American Museum of Natural History in the City of New York $1,000,000, to constitute a permanent fund, the principal to be invested and kept invested, and the income to be applied and apportioned to the general purposes of the museum, other than alterations, additions, repairs, or erection of buildings, the purchase of land, or the payment of salaries, or for labor or for services of any kind ordinarily considered under the item of maintenance. * * *. I believe it [the museum] to be today one of the most effective agencies which exist in the City of New York for furnishing education, innocent amusement, and instruction to its people. It can be immensely increased in its usefulness by increasing its powers.

The following resolution adopted by the American Association for the Advancement of Science at its recent Chicago meeting, on recommendation of Section F (zoölogy) is of interest to the students of plants as well as of animals:

Realizing that the work in the Panama Canal is changing biological conditions in Panama and that the completion of the canal will enable the fresh-water faunae of the two slopes to mingle freely and that many marine animals will succeed in passing the completed canal, the American Association for the Advancement of Science urges upon the President and Congress to make provision for a biological survey of the Panama Canal zone.

Since the conditions will be permanently changed as soon as the canal is completed and the work can not be satisfactorily done after the completion of the canal, there is great urgency that provisions for the work be made at once.

Resolved, That the permanent secretary be instructed to send copies of this resolution to the President, the Vice-President, the Speaker of the House, and the Secretary of the Smithsonian Institution.

Similar resolutions have been adopted by the council of the American Society of Naturalists.

The Boston Society of Natural History announces the following subjects for the Walker Prizes:

For 1908. 1. An experimental study of inheritance in animals or plants. 2. A comparative study of the effects of close-breeding and cross-breeding in animals or plants. 3. A study of animal reactions in relation to habit formation. 4. A physiological study of one (or several) species of plants with respect to leaf variation. 5. Fertilization and related phenomena in a phenogamous plant. 6. What proportion of a plant's seasonal growth is represented in the winter bud? 7. A physiographic study of the forms and processes discoverable along a varied shore line. 8. A problem in structural geology. 9. A study of one or more geological horizons with a view to determining the different conditions obtaining at one time over a large area, as recorded by sediments and fossils.

For 1909. 1. A geographic study of a district of varied features, presented as involving the natural relations of inorganic and organic elements. 2. A petrographic study of a district of crystalline rocks. 3. A paragenetic study of a mineral locality. 4. The conditions controlling sexual reproduction in plants. 5. Studies in the life history of a thallophyte, with special reference to sporogenesis. 6. Contribution to our knowledge of responses in plants. 7. The factors governing orientation in animal responses. 8. The relation between primary and secondary sex characters in animals. 9. The activities of the animal body in relation to internal secretions.

For the best memoir presented a prize of sixty dollars may be awarded; if, however, the memoir be one of marked merit, the amount may be increased to one hundred dollars, at the discretion of the committee. For the next best memoir a prize not exceeding fifty dollars may be awarded. Prizes will not be awarded unless the memoirs presented are of adequate merit. The competition for these prizes is not restricted, but is open to all. Further particulars may be obtained by addressing Glover M. Allen, secretary, Boston Society of Natural History, Boston, Mass.

The thirteenth annual winter meeting of the Vermont Botanical Club was held at the University of Vermont, Burlington, January 17 and 18, 1908. Twenty-two titles appeared on the program and all the sessions were well attended. Among the items of more general interest were the following: Miss Phoebe Towle reported upon observations extending through several

years as to the period elapsing between blossoming and fruiting of various species of mosses. Dr. Tracy E. Hazen noted the occurrence of *Oxalis Brittoniae* in Vermont; G. L. Kirk recorded another station for the rare green dragon (*Arisaema Dracontium*); D. L. Dutton reported the discovery of the rose-root (*Sedum Rhodiola*), thus adding another to the series of arctic plants found in the Green Mountains. N. J. Giddings described a new bacterial disease of melons. In addition to other papers of local concern, two addresses were delivered by visiting scientists. The annual address was by Professor M. L. Fernald of Harvard, who was the guest of the Club and discussed the flora of the Shickshock Mountains and the Gaspé Coast. This was illustrated by lantern slides and specimens and brought out especially the relation of plant distribution to rock formation. Mr. John Ritchie, President of the Federation of New England Natural History Societies, gave an illustrated account of Mount Washington. He invited the Vermont Club to join the other federated societies in a joint field meeting there the first of July next and it was decided so to do. The same officers were reëlected for the ensuing year, viz., president, Ezra Brainerd of Middlebury College; vice-president, C. G. Pringle; secretary, L. R. Jones of the University of Vermont; and treasurer, Mrs. N. F. Flynn of Burlington. Some twenty names were added to the active membership list, which now numbers nearly 200. This is apparently one of the largest organizations of its kind in the country. It publishes an annual *Bulletin* embodying its proceedings and botanical notes of interest to Vermont botanists.

TORREYA

March, 1908

Vol. 8. No. 3.

BOTANY *

By Herbert Maule Richards

What is the content and scope of the science of botany? Popular opinion will answer somewhat easily: Botany consists in the gathering of plants, and the dismembering of them, in connection with the use of a complicated terminology. That is the beginning and end of botany as it is understood by the majority; there is nothing more to be said. In consequence, the employment of the botanist seems so trivial, so very remote from important human interests that no second thought is given to it. The conception formed in ignorance is continued in ignorance. Even the zoōlogist is at an advantage, for the public is finally forced to admit that it does not know what he is about, while it understands the botanist very well. He is quite hopeless, for, while flowers may be pretty things to pick, they should not be pulled to pieces, and if he does not happen to be interested in dissecting flowers he is not a botanist but simply a fraud.

Far from being remote, the study of plants comes very close to human interests. One has but to stop to think that plants are the great energy source for man himself and the animals upon which his well-being depends, to recognize that a careful study of their manner of life, the conditions which favor or hinder their growth is of the very first importance. Besides this, human curiosity demands that plants be investigated, if for no other reason than that they must be made to yield answers to the perpetual questions that man is asking regarding the world about him.

Under botany we have to consider all the questions as to the

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form, the functions, the classification and the distribution of those organisms that are called plants. Along what lines this study is prosecuted, how it is related to other fields of intellectual activity, and some specific instances of its problems and the manner in which they may be solved is what I shall attempt to tell you.

It would be out of place in a talk like this to devote too much time to a consideration of the historical side of the subject, and therefore only a few of the important movements can be pointed out. Any folk which had so far emerged from the stage of savagery as to stop to notice the world about it would perforce pay some attention to plants. A discrimination of the medicinal uses of plants is often noticeable even in primitive peoples, and with such observation goes also the discrimination of difference in form, the prototype of morphological research. I have seen a Malay coolie who could distinguish seven forms of tropical oaks where the botanist recognizes only four, an evidence that sharp observation is not confined to the highly developed races.

In our own civilization, we can trace back the history of botany to Aristotle, who affords us some record of the plant forms known at his time, though the influence which his philosophy wielded, even down to the middle of the last century, was of vastly greater importance than any contribution which he made to botany itself. Theophrastus gave a fuller account of plants, and later came the inquiring and ever curious Pliny. Dioscorides, however, in the first or second century of our era, was one of the first to investigate plants with any attempt at thoroughness even from the standpoint of the knowledge of the time. As is shown especially by Dioscorides' work, the study of plants was largely from their use as drugs, and they were described simply to facilitate their recognition. Any real knowledge of them was naturally meager, and false ideas that clung for a long time, some until comparatively recently, prevented any proper conception of form and function.

As would be expected the contributions become of less and less value as we approach the middle ages, the botanical writings of which time were full of the wildest fantasy and superstition. The efforts of this period need not arrest our attention.

In the sixteenth century in northern Europe, particularly Germany, there was a movement towards the real study of plants from the plants themselves as evidenced by the works of the herbalists, but no attempt at classification was made. Here there was an attempt at the enumeration and illustration of plants from living specimens, and confused and empirical as this work was, it was actuated by an honest endeavor to record, as accurately as possible, actual forms, and not fanciful abstractions which never did and never could have existed. All the descriptions were detached from one another and little or no attempt was made at classification, though by the repeated study of many similar forms the idea of natural relationship began to dawn in a vague way. The actual purpose of all this plant study was the recording of the officinal plants, for special knowledge of plants was still confined to their uses in medicine.

While this movement was advancing in northern Europe, a mainly artificial system of classification was developing in Italy and found its culmination in the work of Caesalpino, who strongly influenced the progress of botany, even after his own time and into the middle of the eighteenth century. Great as was the advance he made, it would have been far greater had it been given him to break away from the scholastic philosophy which hampered him. We find a curious mixture of a modern spirit of inductive natural science and Aristotelian methods of thought. The latter triumphed in the main, and the result was a formal classification built on idealistic abstractions that is wholly fallacious from our standpoint of to-day.

Emerging from such conditions we find Linnaeus — the bicentenary of whose birth was celebrated last year — and though he too was much influenced by the earlier writers, to him belongs the credit of the emphasis on the fact that some natural system of the classification of plants must exist even though he could not determine it. Linnaeus is popularly termed the father of botany and of zoölogy as well, and in many senses there is reason for it. He was a born classifier and brought considerable order out of immense chaos, but still his classification was artificial, and only to a very limited degree recognized the natural relationships

of plant forms. Linnaeus, however, was wise enough to recognize its artificiality.

From Linnaeus the advance was more rapid, and, while most of the study in plants centered on the work of classification, there were unmistakable signs of other interests. The ideas of the classifier were still hampered by the dogma of the constancy of species, which continually clashed with the insistent and undeniable evidences of the genetic relationships of organic forms. Despite the movement in favor of the idea of the development of species from previously existing forms, despite the views advanced by Lamarck and others at about that time, despite, indeed, the more strictly botanical investigations in the morphological field which were brought forward during the first half of the nineteenth century: despite all these things, the botanist was unable to break away from the concept of groups of plants as abstract ideas. It was not until 1859 that the publication of Darwin's "Origin of Species" drove biologists to a different point of view. Then the rational idea of the evolution of organic forms explained in a similar rational fashion the observed genetic relationships of groups of plants. No longer did the classifier hesitatingly admit the possibility of the evolution of species and deny that of genera and higher groups, no longer did he maintain his artificial groups, which had no more relation to each other than successive throws of dice, but he admitted the whole great scheme implied by the evolution of organic forms from preëxisting types.

Naturally, it is difficult to point out at just what time the modern trend of botanical work found its origin, but one can say, in a general way, that it was about the middle of the nineteenth century, although of the two criteria of progress to which I shall refer, one dates about a decade before, the other about a decade after that time. The establishment by the botanist Schleiden in 1838, and by the zoölogist Schwann in 1839, of the real nature of the cell, and the acceptance of what may be termed the cell doctrine, at once made possible the development of the study of form and structure, both as to adult and as to embryonic organs. With improved optical apparatus and with improved technical methods, many able students added a vast number of

demonstrated facts to the general store of knowledge; in fact, for a time the additions to morphological information very much outran the development of the physiological side, though the latter had had a rational beginning at a prior date. The morphological development depended in the first instance upon the understanding that the cell with its living protoplast, and usually with a wall, constituted a not further divisible morphological unit of living organisms; that every cell must have arisen from a preexisting one; and finally, that all but the lower organisms are composed of thousands of these cells differentiated into distinct tissues. One of the most important figures in this advance of botany from Schleiden's time was Naegeli, who brought to bear a powerful intellect on many of the fundamental concepts both of morphology and physiology. Of the many questions dealt with by him, that of the ultimate structure of organized substance was perhaps the most far-reaching; and to-day, despite its limitations, his Micellar Hypothesis is the most stimulating of any of the theories which have been developed regarding this subject.

The other milestone of progress was Darwin's "Origin of Species" already referred to. Entirely aside from the particular question involved in that work, its importance lies in the fact that it fought the battle and won the victory for the inductive method of reasoning as applied to biological science. Previous to the awakening of botany, due to these and related causes, a botanist usually covered the whole field of his science and had the right to consider himself a specialist in all branches of botany. The rapid accumulation of facts soon demanded, however, a segregation of different lines of work. Thus arose the divisions of botanical activity, which, for our purposes, may be classed under three heads. First, the taxonomic, or as more commonly called the systematic side, which has to do with the classification, mainly as established by gross morphology. Second, the morphological field, which concerns itself with the outward and inward form and structure and the development thereof, which may or may not have direct relation with taxonomic work. Third, there is the domain of physiology, which treats of function. As Professor Wilson has pointed out, there are really but two divisions of

biological work, the morphological and the physiological, so that the separation of taxonomy which really belongs in the first division is rather artificial. The separation however is necessary for many reasons, among which are the fact that the temper of mind and the methods of the workers in the two divisions are quite different.

It is perhaps the tendency of the time, at least in many quarters, to underestimate the value of taxonomic research and this is to be regretted since in classification we have the foundations of other branches of work. Entirely aside from the philosophical value of a well ordered classification, it is an absolute necessity for a starting point of morphology and physiology to have the different species of plants recorded in recognizable form, and, in consequence, to have a classification. It would undoubtedly be a great advantage could organisms be classified as are chemical compounds or could they be located as the astronomers locate the stars and in the same definite and precise manner. Such is hardly possible when we reflect that the question of the identity of an organism must, even under favorable conditions, be somewhat a matter of opinion as well as of demonstrated fact. Despite such limitations of taxonomy, in most of the really important questions opinion is fairly universal, so that our classification is not developed simply at the whim of any one investigator. Taxonomy, however, as soon as it is considered an end in itself sinks at once to the level of mere cataloguing or, worse still, loses itself in the mazes of nomenclatorial controversy. It must be considered in its relation to the problems of plant distribution, of the evolution of new forms, of its philosophical intent, if it is to retain its vitality.

I have spoken of artificial classifications in connection with the work of earlier botanists. How then does the natural classification as understood to-day differ? Primarily, it differs in the admission of genetic relationship of forms, a thing not conceived of by older writers. A natural classification implies higher and lower forms, connected by intermediate ones in all stages of differentiation. However, it does not imply that all these forms exist to-day, nor does it imply that they developed in a single

continuous series from the lowest to the highest. We have no particular right to suppose that all plants can be traced back to a single ancestor; indeed, the evidence is against it. There is no reason why several phyla, or lines of ascent, may not have originated, perhaps simultaneously, from the most primitive form of living protoplasm. The story of the lower aquatic forms certainly indicates this possibility. Of these lower phyla some stopped short, some went on, which ones is a matter to be definitely settled. A good instance, though a somewhat special one, to illustrate the fallacy of the assumption of a single line of relationship, is found among the fungi, the chlorophylless lower forms. Many ingenious authors have attempted to unite them in a single continuous series, when every evidence we now have points to their having originated at several places from the green plants. Who, indeed, would care to deny that new phyla might be originating to-day? Any concept of evolution demands such a possibility; organisms are more plastic than the average person conceives, even in this age.

The object of a natural classification is to consider all the many plant forms, to determine by such marks of genetic relationship as we can discover their place in the series, where they have departed from the main stem and in how far they may have had a line of development of their own. Despite what I have said about the lower phyla, it is not improbable that the higher plants can be traced back to some single source, not that it is to be believed for a moment that this ancestor exists to-day. Living ferns or mosses are no more to be considered the direct ancestors of the flowering plants than are monkeys to be considered the direct ancestors of man.

The establishment of our classification to-day might be compared to the putting together of a puzzle map some parts of which are lost; we can determine how many of the parts fit together, and, by analogy, can tell something of the missing ones. The whole method depends on the admission of genetic relationship, a concept that is built up partly by the study of adult structure, partly by the story of the developmental stages, partly, though in botany less than in zoölogy, by the evidence

of paleontology, but more vividly than in any other way by the actual behavior of certain plants in the matter of giving rise to new forms. This last consideration is of such great importance that we shall come back to it later.

One type of morphological investigation has to do with the study of life histories of plants — the whole life story from egg to egg again — and here we find the morphologist in close relation with the systematist, for upon the results of such researches must largely depend the understanding of the relationships of the great groups. The morphologist who devotes his time to the study of life histories is engaged in the work of tracing the race history of plants from the comparison of the individual development of more or less nearly related forms. Thus the homologies which have been traced among the flowering plants and their nearest allies among the ferns and other forms indicate to us the probable race history of these groups. It is true that the beginning of this work dates back some decades, but it is still, to a large extent, an open field, and numerous investigators are actively prosecuting research along these lines. For example, the alternation of a sexual and non-sexual generation of plants which has long been known as characteristic of the life histories of higher forms has recently been established among the lower groups, and thus a much clearer view of the whole series of the plant kingdom is being obtained.

Somewhat separated, and to a large extent needlessly so, is the work of the plant anatomist and histologist. Formerly pursued from the standpoint of the mere topographical relation of the parts, the conception of the plant as an organism with interrelated and interdependent tissues began to fall into abeyance, until a new point of view has within recent times revivified a somewhat barren field. This point of view is the physiological one, the correlation of structure and function. Here the student of gross morphology and the anatomist unite in a physiological interpretation of the form and structure of plant organs, from which has grown the study of experimental morphology. Advance in this direction has been considerable, and we have now a much clearer idea of the nature and development of plant

organs; or at least, we have a much better attitude in the interpretation of the facts that have been established regarding these matters. The danger which lies in this attitude is the well known one of teleological reasoning, and consequently it behooves us to have some caution in accepting, without thorough evidence, the interpretations which may be made of the relation of form and function and of special adaptations for special purposes. As some one has written, "so many things may be true and so few things really are in the matter of use of special organs," that we must demand above all things experimental evidence before we can accept as conclusively proved any statement as to function. It is permissible to say without such proof that such and such an explanation is plausible, but beyond that is uncertain ground and mere assertion shows a temerity at once magnificent and pitiable. On the other hand, it is questionable if the extreme attitude of iconoclasm as to long established interpretations is necessarily a wholly reasonable one. Destructive criticism is not difficult, and unless some new and better interpretation is suggested the advance in a scientific sense is not considerable.

A further development from this physiological attitude is a branch of biological work known as ecology, a study of the relation and adaptation of single plants or whole communities of plants to their environment and to each other. It is the application in a broad and more philosophical way of the methods of the physiological anatomist coupled with those of the taxonomist; but, in addition, the work of the botanist touches the field of the physiographer and geologist. Ecology is the endeavor to uncover the plan of nature as it governs the relations of the different plant forms in a given area, to understand the why and the wherefore of the association of very different forms in one locality. The keynote of the philosophical development of this topic rests on the conception of the constant struggle of individuals or groups of individuals to maintain themselves against other forms, which leads to a balanced relation of the different species in a given flora. Understanding this, we can see why, if this balance is disturbed, the whole fabric of a plant community may be destroyed and a flora swept away. We are also able to

understand how relatively slight climatic changes may alter completely the character of a vegetation in a given region, and thus to comprehend more readily the changes which must have taken place in past ages. It also shows us the effect of present changes, particularly in regard to the destruction by man of the essential elements of natural plant communities, notably one of the most important of these, the forests. Its use lies in these directions and the danger of its misuse lies in the direction of drawing too positive conclusions from data which are insufficient, and of accepting the results obtained as necessarily final, a common error it is true in any line of thought, but one to which the ecologist has especial temptation.

(To be continued.)

COLLECTING AND STUDYING BOLETI

By William A. Murrill

The *Boleti* are fleshy, tube-bearing fungi, the tubes separating quite easily from the flesh of the pileus and from each other. They usually occur on the ground in woods, not more than five of our species being found on decaying wood, and one being parasitic on a puff-ball.

The group always attracts attention on account of the brilliant colors and ephemeral character of its species, and is of special interest because of the large number of edible fungi found in it. One section, with red tube-mouths is considered distinctly dangerous, and some species are too bitter to eat; but with caution one might perhaps use for food over ninety per cent. of the *Boleti* he finds.

Boleti may be collected at any time from June to October, especially if there are frequent rains. In this latitude, July and August usually furnish the largest number of species. To make good specimens of *Boleti* for scientific purposes is probably the most difficult task that presents itself to the field mycologist, and one that he often shirks; which accounts for the scarcity of good specimens of these plants in most herbaria. With some care

and attention to details, however, it is possible for almost any one to do creditable work in this group, and greatly to aid the cause of science in the correct description of species and their proper relations to each other.

Notes made from the fresh specimens are exceedingly important in the case of the *Boleti* because the species are often separated by a number of minor characters which are apt to disappear on drying, and, moreover, because the changes on drying are usually very considerable owing to the large percentage of water. The accompanying blank form will be found useful for these notes, together with small outline sketches of a specimen entire and in section to show its general shape and the relation of its principal parts. It is highly desirable to make also a photograph of the plant or a colored drawing, or both, if time permits; if not, color notes from a color chart, with an accompanying sketch, will be found exceedingly helpful. If one's time is very limited, the following characters should be given preference: the color and color changes of all parts, surface characters of pileus and stipe, form of the veil, taste of the flesh, and color of the spores as shown in a spore-print.

Dried specimens are absolutely necessary for scientific study. Drawings and field notes, no matter how artistic and complete, can never take the place of the plants themselves in the herbarium. Various devices have been used for drying fleshy fungi, the principle being to keep the specimens *continuously* in a current of hot air until *thoroughly* dry. A piece of wire netting suspended above a lamp or a stove forms a simple and efficient drying outfit, which may be enlarged as circumstances require. The dried specimens should be kept in tight boxes with camphor or naphthalene to keep out insect pests.

The determination of specimens is easier while they are fresh, but the collector is often compelled to defer the study of his collections until the winter season brings him more leisure. There are certain advantages in this delay, however, because of the array of specimens at hand at the same time for comparison and the combined experience of the entire season in becoming acquainted with variations and distinguishing characters. If one is

NAME ....

Locality, Date

Habitat

Habit

Size

PILEUS ....

Shape

Color

Changes

Surface

Margin

Veil

Annulus

CONTEXT ....

Consistency

Color

Changes

Odor, taste

TUBES ....

Attachment

Color

Changes

Mouths

Form

Spores

Print

STIPE ....

Attachment

Shape

Color

Changes

Surface

Substance

Changes

Remarks ....

near a botanical institution, he can also, perhaps, make use of a named collection and the literature bearing on the group.

The best single publication on the *Boleti* for field work and general use is Peck's "Boleti of the United States" (Bull. N. Y. State Mus. 2: 73–166, 1889), in which most of our common species are described and classified. Underwood's "Suggestions for the Study of the North American Boletaceae" (Contrib. Dept. Bot. Columbia Univ. No. 176, 1901), is a valuable supplement to Professor Peck's work, giving citations to literature and illustrations, a list of species known to date, and revised keys with species recently described incorporated. There are no descriptions, however, and the work can be used only in a supplementary way. Atkinson's "Studies of American Fungi" includes full descriptions of a limited number of *Boleti* common in the state of New York. McIlvaine's "One Thousand American Fungi" covers the group most fully, eighty pages being devoted to descriptions and illustrations of *Boleti*, mostly upon the authority of Professor Peck. The majority of the illustrations are, unfortunately, poorly executed and often misleading. The beginner is also warned against adopting too readily the author's ideas regarding certain species considered poisonous by most mycologists, as it is possible that the specimens experimented upon were not in all cases accurately determined. This is especially liable to be true in the case of European species said to occur in this country. No attempt is here made to discredit Captain McIlvaine's valuable work, but the suggestion is that the relation between European and American forms has not yet been satisfactorily determined, even by our best mycologists.

A correct and useful system of classification of the one hundred and fifty or more native species of *Boleti* is rather difficult to construct, with our present limited knowledge of many of the species. For the time being, it is probably best to divide the family into groups that are easily distinguishable, even though arbitrary in some cases, and let the collector record the group to which a plant belongs while it is still fresh. This will greatly facilitate the classification of specimens after they are dried, and will often take the place of valuable data omitted by the collector.

The chief characters used in this temporary grouping are the position of the stem, the habitat of the plant, the coherency, size, and arrangement of the tubes, the presence of a veil, viscid dots on tubes and stem, red mouths to the tubes, a lacerated and deeply-grooved stem, adnate or free tubes, a yellow powder covering the entire plant, and flesh-colored or blackish-brown spores.

The spores vary but little, considering the number of species, most of them being fusiform in shape and ochraceous-brown to ferruginous in color. Flesh-colored, pale-yellew, purplish-brown and blackish-brown spores occur, but they are exceptional. A greenish tint is noticed in the fresh spores of many species, but it usually disappears on drying.

Certain other characters, such as reticulations on the stem, viscidity, changes in color of flesh or tubes, and inconspicuous surface coverings, often vary with age, locality or the weather in some species, and may or may not be reliable, but may be conveniently used at times in connection with more important characters to distinguish certain groups.

A key to these provisional groups is given below, each group being designated by a letter. Well-known species have been used in the key as examples of various groups, as a means of ready identification and comparison.

Groups of North American Boleti

Tubes separated from each other; stem lateral; plants found on decaying stumps, trunks or roots. (*Fistulina hepatica.*) **A**

Tubes attached to each other; stem central, rarely eccentric; plants terrestrial, except in very rare instances.

- Tubes arranged in radiating rows. (*Boletinus porosus.*) **B**
- Tubes usually small, not arranged in radiating rows.
  - Pileus conspicuously floccose.
    - Spores blackish-brown. (*Strobilomyces strobilaceus.*) **C**
    - Spores ferruginous. (*Boletus Ananas.*) **D**
  - Pileus glabrous or subtomentose.
    - Stem annulate. (*Boletus luteus.*) **E**
    - Stem exannulate.
      - Stem and tubes glandular-dotted with a gummy secretion that hardens and turns black soon after exudation. (*Boletus granulatus.*) **F**
      - Stem shaggy and lacerate, with deep reticulated furrows; spores olive-brown. (*Boletus Russellii.*) **G**

Stem hollow at maturity; spores pale-yellow, elliptical. (*Boletus castaneus.*) **H**

Stem and pileus covered with a conspicuous sulphur-yellow powder. (*Boletus Ravenelii.*) **I**

Not as above.

Spores flesh-colored; tubes adnate, whitish, tinted by the spores at maturity. (*Boletus felleus.*) **J**

Spores not flesh-colored, usually yellowish-brown.

Tubes with red or reddish-brown mouths, yellowish within. (*Boletus purpureus.*) **K**

Tubes not as above.

Tubes free, white, not stuffed when young; stem not reticulated, often scabrous. (*Boletus scaber.*) **L**

Tubes adnate, white or yellow, not stuffed when young.

Stem reticulated. (*Boletus ornatipes.*) **M**

Stem not reticulated. (*Boletus chrysenteron.*) **N**

Not as above. (*Boletus edulis.*) **O**

New York Botanical Garden.

SHORTER NOTES

Jungermannia in New Hampshire.—All four species of the genus *Jungermannia* hitherto reported from New England have been collected by the writer at Waterville, New Hampshire, during 1906 and 1907. This, while a non-calcareous region, is well supplied with all the bryophytes to be expected there.

The commonest is *J. lanceolata* L., reported from all the New England States. By living on rocks or humus, it is independent of the underlying geological formations; but the other three are rock- and talus-growing plants, and avoid limestone at that. As *J. lanceolata* is unmistakable when fertile, it is herewith dismissed.

New Hampshire is the only state from which the subalpine *J. sphaerocarpa* Hook. is reported. It is found at Waterville on wet granite ledges, facing north, at 2,500 feet altitude, and with abundant perianths. It is a delicate plant, of a clear light-green, without much trace of purple; and it grew mixed with *Marsupella emarginata* (Ehrh.) Dum., *Lophozia alpestris* (Schleich.) Evans, etc.

The other two species were on granite rocks in Mad River, at

Tyler's Spring (45°) at 1,500 feet altitude. This large spring cools the whole neighborhood, but whether that has any bearing upon the occurrence of these particular species here is not known to the writer.

Jungermannia pumila With. grew on the large stones in the river just above the water-line, and bore plenty of perianths. It was in neat dark-green tufts, which were very noticeable among the *Scapaniae*, *Grimmiae*, *Rhacomitrium aciculare*, etc., occupying the same rocks. Reported from Vermont, New Hampshire and Connecticut.

Jungermannia cordifolia Hook. was also on the river rocks in front of the spring, just at the water-line, some of it, in fact, being submerged, although the river was low this year. This is the second station for New England, the other being at Rainbow, Conn. (See Evans, Rhodora **6**: Jl 1904). These plants were sterile, and small, as they grew on the rocks with only a little sand about their rhizoids, but were otherwise characteristic. They are purplish-black, in contrast to the last-named species, and are most distinct, with their heart-shaped leaves, thin cell-walls without trigones, and flagella. It should be sought in the remaining New England states. The allied *J. riparia* Tayl. is a limestone plant.

Without doubt there are other species of this genus still undetected among the White Mountains, especially in the vicinity of Mt. Carrigain, which is as yet practically unexplored.

ANNIE LORENZ.

HARTFORD, CONNECTICUT.

REVIEWS

Cole's Bermuda in Periodical Literature *

The author of the handsome and scholarly book that has recently appeared under the title of "Bermuda in Periodical Literature" has given especial attention to the botany, zoölogy

* Cole, George Watson. Bermuda in Periodical Literature, with occasional references to other works: A Bibliography. Pp. ix + 275. With portrait of the author and eight facsimiles of title-pages of ancient books on Bermuda. 1907. The Boston Book Company. $3.00.

and geology of the Bermudas, in so far as these sciences have been represented in periodicals and in the transactions of learned societies. Of the 1,382 entries, 45 of botanical interest are found indexed under "Flora," and a considerable number of additional titles occur under "Algae," "Fungi," "Diatomaceae," "Cedar-tree," etc. Nearly all of the articles cited have passed under the eye of Mr. Cole, and notes giving brief summaries of their substance add greatly to the value and interest of the book. Only three hundred and fifty copies of the work were printed, of which two hundred were for the author. "Bermuda in Periodical Literature" will be of much service not only to those interested in Bermuda from the historical and scientific standpoints but also to any prospective visitor who wishes an intelligent outlook upon what has been written of these islands.

MARSHALL A. HOWE.

PROCEEDINGS OF THE CLUB

JANUARY 29, 1908

The meeting for January 29, 1908, was held in the museum building of the New York Botanical Garden at 3:30 P. M. Vice-President Barnhart occupied the chair and there was an attendance of thirty-four.

The secretary presented the report of Mr. Percy Wilson, chairman of the field committee, for 1907. Twenty-five field meetings were reported scheduled through the months of May to October inclusive, though a few of these meetings were not held on account of inclement weather.

Mr. Edwin B. Bartram, Wayne, Pa., was nominated for membership, and resignations from Mr. W. W. Eggleston and Mr. Eugene Smith were read and accepted. On motion, the secretary cast the vote of the Club electing Mr. Edwin B. Bartram to active membership.

A motion was made and passed that the officers of the Club be authorized to incur necessary expenditures pending the adoption of a budget for the current year. On motion the secretary,

treasurer, and editor were elected as a committee on the annual budget for 1908.

Biographical résumés and appreciations of Professor Underwood's life and work were read as follows:

"A Biographical Sketch of Lucien Marcus Underwood," by Carlton C. Curtis.

"Lucien Marcus Underwood: A Memorial Tribute," by Marshall A. Howe.

"The Published Work of Lucien Marcus Underwood," by John Hendley Barnhart.

"Professor Underwood's Relation to the Work of the New York Botanical Garden," by N. L. Britton.

The above papers will be published in full in the January, 1908, number of the "Bulletin of the Torrey Botanical Club."

The following resolutions, presented by a committee of the Club were read and unanimously adopted:

In the death of Lucien Marcus Underwood, American botany has lost one of its foremost representatives, one who was exceptionally free from prejudice and selfishness and who abhorred all superficiality and obsequiousness. The Torrey Botanical Club has lost a faithful officer and a zealous and enthusiastic supporter of all its activities and interests.

We desire to pay tribute to his superior qualifications and attainments as a man of science, and to express our profound sorrow as we attempt to realize that we shall no more feel the warm clasp of his hand, meet the glance of his sympathetic eye, or hear his cheering words of counsel and encouragement.

The Torrey Botanical Club hereby directs that this minute be entered in its proceedings and duly published with them.

Adjournment was at 4:45 o'clock.

C. Stuart Gager,
Secretary.

February 11, 1908.

The meeting was held at the American Museum of Natural History and was called to order by President Rusby at 8:10 P. M. Sixty-five persons were present.

The chairman appointed the following committees of the Club for the current year.

Finance. — Judge Addison Brown, Prof. H. M. Richards.

Admissions. — Dr. J. K. Small, Mr. G. V. Nash, Dr. C. C. Curtis.

Local Flora. — (Phanerogams) Dr. R. M. Harper, Dr. N. L. Britton, Miss Fanny A. Mulford, Mr. Eugene P. Bicknell, Mr. Richard Schneider; (Cryptogams) Mrs. E. G. Britton, Dr. M. A. Howe, Mr. R. S. Williams, Dr. W. A. Murrill, Dr. Philip Dowell.

Program. — Dr. Tracy E. Hazen, Dr. E. B. Southwick, Mr. Charles L. Pollard, Mrs. E. G. Britton, Miss Jean Broadhurst.

Field Meetings. — Mr. Charles L. Pollard, Mr. G. V. Nash, Mr. F. K. Vreeland.

The special committee on the "budget" for 1908 made a report on the estimated income and expenditures of the Club for the current year.

Dr. E. B. Southwick moved the appointment of a special committee to draft resolutions on the death of Morris K. Jesup, late president of the American Museum of Natural History. The chairman appointed as such committee Dr. E. B. Southwick, Dr. John Hendley Barnhart, and Dr. N. L. Britton.

The scientific program of the evening consisted of an illustrated lecture by Dr. A. J. Grout under the title "A Botanist's Vacation in North Carolina." The lecture was of a semi-popular character and the numerous lantern-slides from photographs taken by the speaker illustrated the scenery and fauna as well as the flora of the mountains of western North Carolina. The speaker's abstract follows:

Seven weeks of last summer's vacation were passed in the "Pink Beds" on the estate of Geo. W. Vanderbilt about forty miles west of Asheville and twelve miles from Brevard. Our visit was made possible and profitable through the assistant director of the Biltmore Forest School, Dr. Clifton D. Howe. The "Pink Beds" is a mountain valley over 3,000 feet above sea-level and derives its name from the color given to the whole valley in spring by the innumerable blossoms of *Azalea*, *Rhododendron*, and *Kalmia*. The climate is cool, like that of Vermont and New Hampshire, but the almost daily thunderstorms, often

almost torrential in character, are an inconvenience to the botan ist. The fauna as well as the flora is an interesting mixture of northern and southern forms. Many of the forms which at first seem identical with northern species on closer examination are found to have good varietal or even specific differences. The chipmunk, for instance, is undoubtedly a chipmunk but so dark in color as to be scarcely recognizable when first seen. Of our familiar northern flowers, the daisy, evening-primrose, trailing arbutus, Indian pipe, *Clintonia borealis*, two species of *Trillium*, bluets, Indian turnip, and many others are common; of the shrubs, witch-hazel, *Kalmia*, *Rhododendron maximum*, the pink and the white azalea are noticeable; of the trees, the chestnut, several species of oak, hickory, a few sugar maples, a few white and pitch pines, some ash, and the sassafras, all seem to give the country a familiar look. But on the other hand two additional species of *Rhododendron*, the flame-colored *Azalea*, the chinquapin, the great number of tulip-trees and magnolias, the *Nyssa*, *Oxydendron*, Carolina hemlock, and other unfamiliar trees, the open forest filled with innumerable unfamiliar flowers or unfamiliar species of familiar genera, such as *Phlox*, *Lilium*, *Listera*, *Habenaria*, etc., emphasize the difference in one's latitude and keep one's interest awake.

Miss Gertrude S. Burlingham found about the same number of species of *Lactaria* in Vermont and in North Carolina, *i. e.*, 30–35, and about half of this number were common to both.

About 130 species of mosses were collected; of these about 100 are found in Vermont, but many of these 100 differ appreciably from northern forms.

Hookeria Sullivantii, *Entodon Sullivantii*, *Raphidostegium Novae-Cesareae*, *Pylaisia subdenticulata*, *Campylopus introflexus*, *Campylostelium saxicola*, and three species of *Zygodon* were some of the interesting species collected. The moss flora was found to be essentially like that recorded by Mrs. Britton from southwest Virginia, but 15–20 species that she did not find were collected and several common northern forms which she recorded were not met with. The absence of *Polytrichum commune* and *Harpidium* and the abundance of *Entodon*, *Thuidium*, and *Fissidens subbasilaris* were very notable.

The open pasture-like mountain summits, covered with herbs and some low trees, contrasted strongly with the rocky barren ridges of the northern Appalachians, and spruces and firs (*Abies Fraseri*) hardly appear under 5,000 feet altitude.

MARSHALL A. HOWE,
Secretary pro tem.

OF INTEREST TO TEACHERS

HIGH SCHOOL BOTANY. — It has been suggested that a page of special interest to high school teachers be added to TORREYA. Many of the members are teachers, and there is now no recognized botanical journal interested in high school botany. Few teachers are satisfied with the work they are now doing, and the discussion that such a page should provoke would enable us to come nearer the answers to the following questions:

1. Why can so few teachers defend the high school courses they are now giving?
2. Does the present dissatisfaction felt by the teachers indicate that the work is poor?
3. Is the statement that pupils dislike botany (and zoölogy) true? If so, how do you account for it in the case of botany?
4. Why do so few pupils offer botany for college entrance?
5. Should botany be more closely related to the other science subjects, making a continuous four year course in science (as in Latin, English, and Mathematics in our best high schools)?
6. Why does not the study of botany more often create a lasting interest? Would this be secured by more emphasis on morphology (including classification)?
7. Should the physiological work be more or less quantitative? If qualitative only, how can correct ideas as to time, amount, etc., be assured?

Botany, both as a pure science and as a practical science, has never held a higher place. If we, as teachers, cannot successfully deal with it in our high school classes, there must be something fundamentally wrong. What is it? Is the aim unformu-

lated? Are our methods at fault? Is botany placed too early in the high school curriculum? Do the botanists know where the difficulty lies? Can we teachers find out? Send in your criticisms — favorable and unfavorable. Give us any suggestions as to subject-matter and its arrangement, methods, and that *bête noir*, note-books.

The sixth and seventh questions will be discussed in the April number. Other questions will be taken up in the following numbers if sufficient interest is manifested in this new departure of TORREYA.

JEAN BROADHURST.

TEACHERS COLLEGE.

NEWS ITEMS

Dr. Carlton C. Curtis has been promoted from instructor in botany to adjunct professor of botany in Columbia University.

Dr. H. L. Shantz of the University of Missouri has been appointed professor of botany in the State University of Louisiana.

A Transvaal Biological Society has been formed at Pretoria to promote the discussion and investigation of biological problems.

Mr. H. R. Fulton of the Louisiana Experiment Station has accepted a position in the department of botany at the Pennsylvania State College.

Mr. W. W. Eggleston, who is working upon the North American thorns, has been assigned a research scholarship for two months in the New York Botanical Garden.

It is reported that Dr. Forrest Shreve, associate professor of botany in the Woman's College of Baltimore, has accepted an appointment on the staff of the Desert Botanical Laboratory of the Carnegie Institution at Tucson, Arizona.

The January number of the Bulletin of the Torrey Botanical Club was made a memorial of Professor Lucien Marcus Underwood. The longer contributions are by Dr. C. C. Curtis, Dr. M. A. Howe, Dr. J. H. Barnhart and Prof. N. L. Britton.

"The Guide to Nature and to Nature Literature" is the title of a new magazine which is announced to begin publication this

spring. It is to be the official organ of the "Agassiz Association" and will be edited by Edward F. Bigelow, who for many years has had charge of the "Nature and Science" department of "The St. Nicholas Magazine."

Mr. William Kent, of Chicago, Ill., and Kentfield, Cal., has presented a tract of 295 acres of magnificent sequoias in Redwood Canyon, near San Francisco, to the government. The tract lies on the southern slope of Mount Tamalpais, six miles from San Francisco, and is one of the few tracts of redwood forest in its natural state in all California.

The Field Museum of Natural History, Chicago, has received through the University of Chicago, the complete herbarium of that institution, which was inaugurated and augmented by Professor J. M. Coulter during the past twenty-five or more years of his active botanical researches. The herbarium contains about 50,000 sheets, among which are a large number of types, co-types and specially studied species.

At a meeting of the Council of the New York Academy of Sciences held on March 2, the president was authorized to appoint a committee of arrangements for the Academy's celebration of the one hundredth anniversary of the birth of Charles Darwin and the fiftieth anniversary of the publication of his "Origin of Species." This committee has been constituted as follows: Messrs. Hovey (chairman), Beebe, Bristol, Britton, Bumpus, Cattell, Chapman, Crampton, Dean, Howe, Kemp, Osborn, Rusby, Stevenson, Wheeler, and President Cox, *ex officio.*

Austin Craig Apgar, of the N. J. State Normal School, died March 3 of apoplexy. Professor Apgar was born in 1838 and in 1862 was graduated from the N. J. State Normal School, where he afterward taught for more than forty years. He studied in the summer schools of Louis and Alexander Agassiz and was himself widely known as a summer school and institute instructor. His best known books are "Birds of the United States" and "Trees of the Northern United States"; he left unfinished a large and valuable book on American trees. Professor Apgar was one of the earliest advocates of field and laboratory work and never lost the naturalist's enthusiasm.

Press dispatches bring the sad news of the death in Guatemala on March 8 of Professor William A. Kellerman, head of the department of botany of the Ohio State University. In company with several student assistants he was on his fourth winter expedition to Guatemala, as was briefly noted in the February TORREYA. Professor Kellerman was born in Ashville, Ohio, May 1, 1850, was graduated from Cornell University in 1874; and received the degree of Ph.D. from the University of Zürich in 1881. He was professor of botany in the Kansas State Agricultural College from 1883 to 1891, since which time he had been professor of botany in the Ohio State University. In 1885, in association with J. B. Ellis and B. M. Everhart, he established *The Journal of Mycology*, which, in 1889, on the completion of the fourth volume, was continued by the U. S. Department of Agriculture as a bulletin of the Section of Vegetable Pathology until 1894, when its publication ceased, only to be resumed in 1902 as an independent organ under the editorship of Professor Kellerman. In addition to numerous papers on the fungi, Professor Kellerman was the author of a text-book under the title of "Elements of Botany," an "Analytical Flora of Kansas" (with Mrs. Kellerman), a "Catalogue of Ohio Plants" (with W. C. Werner), and a large number of short articles involving a wide range of botanical activity. Professor Kellerman was a member of the Torrey Botanical Club.

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BOTANY *

By Herbert Maule Richards

It is in the field of physiology more than anywhere else, perhaps, that the worker must humble himself before the immensity of the problems before him; that he must realize how fragmentary is the most advanced knowledge of this subject. The foundation stone of physiology is chemistry, and consequently its advance must go hand in hand with the advance of that science; but there is also, it must be admitted, the element of empiricism, which is an unfortunate necessity in any branch of learning where any considerable mass of facts are not yet correlated. The greatest advances are made in the direction of resolving this empirical information into more compact and definite form, a task only possible by the accumulation and correlation of great masses of data in connection with the more definite information afforded by chemistry or physics and more particularly modern physical chemistry. It is plain, then, that we can never go ahead of the data afforded by these sciences, but must always follow somewhat behind them. It must not be supposed, however, that physiology is in a nebulous condition, despite the fact that we are but on the margin of the unknown. Distinct and creditable advances have been made since the days when the knowledge of plant morphology and the chemistry of Lavoisier made possible any reasonably satisfactory explanation of the functions of plant organs. The establishment of a proper understanding of how the plant obtains its food has been a matter of the utmost importance, both from the development of theoretical physiology, and from the standpoint of practical use. We

* A lecture delivered at Columbia University in the Series of Science, Philosophy, and Art, December 4, 1907, copyrighted and published by the Columbia University Press, February, 1908, and reprinted by permission in Torreya, beginning with the March number.

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know not only the definite chemical elements which are essential for plant life, but we know also the quantity and form in which they are most favorable for plant growth. Having established this, it is possible to understand the rôle of plants in the general economy of the world, and how their manner of life, in a broad sense, supplements that of animals. There is also pretty definite information as to the physical phenomena connected with the absorption of the raw food materials which the plant afterwards elaborates, information which is largely due to the classic researches of Pfeffer, whose work, it may be remarked, also afforded van't Hoff valuable data for his contributions to the establishment of the modern physical chemistry. Application of the laws of diffusion and of osmosis, as shown by Pfeffer, enables us to understand why a plant may absorb more of one mineral salt than of another, though both be presented to it in solutions of equal concentration; why it cannot absorb some substances at all, while on the other hand it cannot avoid absorbing certain substances, even though they be violent poison and kill the protoplasm of the absorbing cell at once. We understand also a good deal of the mechanism of the production from simple inorganic substances of the first organic food by the green plant, the first organic food of the whole organic world. While, as will be shown later, the precise details of this process are not fully understood, the general facts are a matter of almost common information, so well known that I hesitate to speak of it here, though to sum up the matter in a few words it may be said that this process of photosynthetic activity of green plants is carried on by the living cells in the presence of sunlight, through the agency of the green coloring matter — chlorophyll — which is present in the leaves, and that the chemical reaction involved results in the union of the carbon dioxide absorbed from the air, with water absorbed from the soil, to form the first simple carbohydrate that is to be detected in easily recognizable form as starch. The fact that this process takes place does not interfere with the operation of another one, namely, the absorption of oxygen with the giving forth of carbon dioxide, that is concerned in the mechanism of respiration. Respiration as a means of

releasing the stored energy in available form for the constructive work of the organism is as necessary in plants as it is in animals. These four fundamental questions, namely, the inorganic substances required by plants, the manner of their absorption, the manufacture of the first organic food, and the nature of respiration are perhaps the most important physiological facts, in the field of nutrition at least, which have been definitly established; and from any point of view their importance is a far reaching one.

In the other great field of physiological research, the study of the mechanism of growth and change of form, much information, made possible by the proper understanding of the cellular character of all living organisms, has established many facts as to the relation of plants to the great physical forces which govern the conditions, the rate and the direction of their growth. This is the study of the dynamics of plants, of when and how the energy released by the nutritive functions is applied to the upbuilding of new tissue and the movement of plant organs. Besides the questions concerned in the influence of diffusely exerted external factors, there are also the effects produced by these same forces when the stimulus is unequal or one-sided. The latter conditions result in characteristic growth curvatures or tropisms, which continue until the plant organ by its own action is brought once more into a state of equilibrium with the external forces. In short, the various plant organs are attuned to the normal conditions of equilibrium under which they grow, and have the ability to perceive and, to a limited extent, to transmit the impulses resulting from a disturbance of that equilibrium. This brings us to the question of the sense perception of plants, manifested in a somewhat bizarre fashion in the sensitive plant, but we should go very slowly in the direction of interpreting this perception in the same terms that we do that of higher animals. It is not for an instant to be supposed that plants have any nervous system such as is characteristic of the higher animal forms. While plants can and do respond to differences in light intensity less than that which the human eye can perceive, it is gratuitous to suppose that there is anything analogous in the two processes. The possibility of any reasoning action or instinct on the part

of plants is a question that the plant physiologist does not seriously entertain.

In selecting for discussion present-day problems which may be considered fundamental, one is embarrassed by the wealth of material and therefore but one more or less connected series of topics which leads up to the modern mechanistic conception of life processes has been chosen. In doing so it has been necessary to ignore equally important questions which, though developed from no less a mechanistic standpoint, are more scattered.

In referring to the assimilation of carbon dioxide by green plants and the production of organic food thereby, it was necessary to admit that the details of the process are not satisfactorily known. It is evident, however, that the starch, which is the first substance that we readily recognize, is not the first substance which is formed. Modern research points more and more to the conclusion that it is the simplest of carbohydrates that is produced, — a substance known as formaldehyde. But what is especially interesting is that it seems not impossible that this primal reaction may not after all be a function of the living protoplasm, but a chemical reaction that can be carried on outside the cell through the agency of chlorophyll. It is in the further elaboration of this first substance formed that the living protoplasm is apparently necessary. At any rate we know that the energy demanded for the process must be afforded by the particular rays of sunlight which the chlorophyll absorbs.

In this photosynthetic activity of the green plant the carbohydrate supply of the world has been accounted for, but there is an equally important question not concerned in this process, namely, the source of nitrogen. Nitrogen is of course an essential element for the construction of protoplasm. As is well known most plants can utilize it in simple combination with oxygen in the form of a nitrate, a sharp contrast, by the way, to the typical animal which requires it offered as an organic compound. It is also known that the same plants cannot assimilate the free nitrogen of the atmosphere, and further, in the processes of decay, free nitrogen is liberated by the breaking down of the nitrogen compounds in dead organic matter. The logical conclusion of

these momentous facts is that soon all the world's supply of combined nitrogen would be exhausted — neglecting the relatively small replenishment induced by cosmic forces — so that green plants and consequently animals, would not have the wherewithal to live, unless there were some organisms which could avail themselves directly of this inert gas. Now there are plant organisms which have the ability to assimilate the uncombined nitrogen of the air: certain bacterial forms, and it also appears some somewhat higher plants. But the operations that lead to this result are by no means satisfactorily explained, and the whole topic is one of live interest both from a theoretical as well as a practical standpoint. It should be added that from the latter point of view, a process by which a combination of nitrogen with other elements in a form that is acceptable to green plants has been devised, and bids fair to become of great importance, for combined nitrogen is the great need of the organic world.

The processes of nitrification naturally lead us to the question of the elaboration of nitrogen compounds within the cell, of the final construction of proteid material that is the actual food of the protoplasm; but here we are much in the dark, partly because we have so little real information as to the chemical structure of the more complicated nitrogenous substances. The explanations now given as to how this elaboration takes place are largely hypothetical and must be regarded as quite unsatisfactory.

A step further from the proteid food is the question of living protoplasm itself, and one of the most interesting problems connected with this is the nature and functions of the enzymes, — the ferments and digestive secretions of living cells. Many of the newer theories as to the nature of living protoplasm hark back to investigations regarding enzymes, indeed some extremists advance the opinion that the activities of the live protoplast are in themselves but the result of the interaction of substances enzymatic in their nature. There is no doubt of the power of the appropriate enzymes when present even in infinitesimal amount to cause enormous molecular changes in the substances on which they act, but it is necessary to exercise extreme caution before

accepting generalizations along this line, no matter how brilliant. The amount of empirical information in this field is already becoming unwieldy, and nowhere else is the necessity of unifying principles so plainly shown. Here it is that more definite chemical knowledge may in one stroke clear up the whole situation.

If it is not possible to ascertain the chemical structure of a single enzyme, how much more difficult then must it be to determine that of the living protoplasm? It goes without saying, that if we try to analyze the living protoplasm, in the ordinary chemical sense, we kill it. This being the case, the student who is trying to penetrate these difficult problems must have recourse to other modes of attack. Therefore does he experiment with the effect of agents which do not kill but merely stimulate the organism or partially inhibit its functions and, by studying the nature and products of the reactions produced, obtain in an indirect manner clues to the real nature of life processes. The fascination of these plunges into the unknown is perhaps hardly comprehensible to those who are not engaged in the work, but all must admit the importance of the end they have in view, namely to penetrate a little further into the mystery of life. The advance in all these fields is of necessity along the line of the mechanistic conception of vital manifestations, that is, the reference of them to chemical and physical laws. To appeal to a "Vital Force" is, as my predecessors in these lectures have said, to appeal to an empty name, a mere "question-begging epithet." It is obvious that if we are to make any progress at all, we must admit of the possibility of some solution that our senses can perceive, even though we are perfectly willing to admit that the final answer may never be reached. The reference of vital phenonema to a vague "Vital Force" would mean the extinction of inquiry by robbing the investigator of any sense of responsibility for adequate explanations of the results of his researches.

(*To be continued.*)

STUDIES IN THE OPHIOGLOSSACEAE — I

A Descriptive Key to Ophioglossum in the United States

By Ralph Curtiss Benedict

The following synopsis is designed to serve two purposes: to express some of the relationships existing between the various described taxonomic units of the genus, and to further the identification of these units. The terminology used is explained in the following generic description.

Plants small, terrestrial; the rhizomes small, erect, more or less tuberous; the fronds one to four, herbaceous, consisting of a usually short, cylindric commonstalk, bearing at its summit an entire, oblique or horizontal, linear-lanceolate to reniform, sessile or short-stalked lamina, and a single, usually long-stalked spike, the sporophyl.

The terminology in the Ophioglossaceae is in a rather unsatisfactory state. Prantl, who has given the genus *Ophioglossum* a very thorough systematic treatment, used the Latin equivalents for "leaf" and "petiole," and spoke of the sporophyl as "arising from the petiole or base of the lamina." But the lamina and sporophyl seem to be morphologically coördinate, so that this expression is inaccurate. Professor Underwood has used instead of "petiole" the term "common stalk," which, although not altogether satisfying, is at least not misleading, and this expression is adopted here, being used, however, as a single word.

Morphological studies of the group seem to demonstrate that the structure here called a "frond" is undoubtedly foliar in origin. On this account, the "common stalk" might as well be called a common petiole, but here the analogy ceases, for the vegetative and reproductive structures above certainly do not correspond to the blade or lamina in ordinary fern or flowering plants. Perhaps the best way out of the difficulty would be to coin one or more new terms for the anomalous structures in the family, but this can best be left to the morphologists at whose hands the group needs further study.

The genus may be subdivided as follows:

Lamina deltoid-ovate or cordate, base auriculate or truncate; rhizome globose, 5–10 mm. thick; commonstalk short, hypogean; fronds two to four, rarely solitary; spike short and stout. (Southern States, Mexico and South America.)
1. *O. crotalophoroides* Walt.*

Lamina lanceolate or spatulate to ovate, rarely broader, base acute, obtuse or rounded.

Plants normally small, usually less than 9 cm. high (1.5–11.5); fronds two or three, rarely solitary; commonstalk hypogean, usually less than $\frac{1}{3}$ the height of the plant.

Rhizome very small, short-cylindric to globose, 2–5 mm. long, 1.8–5 mm. thick, lamina usually plane and horizontal, $\frac{1}{8}$–$\frac{1}{4}$ the height of the plant; median vein emitting one or two branches, areolae mostly small and divergent; spores 0.030–0.040 mm. thick. (Southern States and Cuba.)
2. *O. tenerum* Mett.

Rhizome larger, long-cylindric, 2–17 mm. long, 2–3 mm. thick, lamina usually folded and upwardly inclined, $\frac{1}{4}$–$\frac{1}{2}$ the height of the plant; median vein simple except for secondary connecting veinlets, areolae mostly larger and parallel; spores 0.040–0.050 mm. thick. (California and Mexico.) 3. *O. californicum* Prantl.

Plants larger, usually more than 12 cm. high (6–40); fronds usually solitary; commonstalk $\frac{1}{2}$ or more epigean, $\frac{1}{3}$–$\frac{4}{5}$ the height of the plant.

Lamina lanceolate, spatulate, elliptic, oblong or ovate, apex rounded or sometimes acute, not apiculate; spores reticulately marked with thin ridges, more or less verrucose.

Plants usually more than 15 cm. high; lamina variable in shape; commonstalk usually $\frac{1}{2}$ the height of the plant or more, mostly epigean. (Usually in wet boggy ground, Northeastern North America, Europe and Asia; also in Mexico?) 4. *O. vulgatum* L.

Plants mostly less than 15 cm. high; lamina lanceolate or elliptic; commonstalk about $\frac{1}{3}$ the height of the plant, about $\frac{1}{2}$ hypogean. (In sand, New Jersey, New York and New Hampshire.)
5. *O. arenarium* E. G. Britt.

Lamina elliptic or rarely ovate, usually acute, apiculate; spores merely finely pitted, faintly verrucose. (Virginia and Indiana to Mexico.)
6. *O. Engelmanni* Prantl.

Prantl, in his monograph, in which he treats the genus from a world-wide point of view, divides what he considers to be *Euophioglossum* into two groups of species according to the branching or non-branching of the mid-vein of the lamina, one of the characters used here to distinguish *O. tenerum* from *O. californicum*. In a general treatment, it may be necessary to make use of this

* *O. reticulatum* L. of tropical regions in general, is like *O. crotalophoroides* in the shape of the lamina, but differs in its greater size, usually solitary fronds, and in having a long, mostly epigean commonstalk, and a cylindric rhizome.

character, but it is hardly satisfactory even when most distinctive, and is often obscure and hard to ascertain, and, in a consideration of the species of a relatively limited area, its use may well be avoided. In his treatment of the American species, Prantl's work is in some respects deficient, owing to the fact that his material of these plants was for the most part scanty. For example, his description of *O. crotalophoroides*, a species originally from South Carolina, was with two exceptions based on South American collections. Of *O. californicum* he saw only part of one collection, of *O. tenerum*, one specimen, and similarly of others from South America. The result has been that some of his descriptions are rather incomplete, but in view of his insufficient material it is to be wondered that he was able to define the species as accurately as he did, and it is a tribute to his ability that his conception of specific limits has, after study of ample material, been generally affirmed.

New York Botanical Garden.

THE STORY OF THE MANGROVE

By George V. Nash

Those who have been to the southern parts of our own state of Florida, or have visited the shores of tropical America, have perhaps noticed, fringing the shores in many places, a shrub or small tree, from the horizontal branches of which descend long gaunt roots, and bearing, usually in great profusion, long club-shaped pendulous bodies which sway and dangle in every breeze. But have you realized the vast importance of this plant and the tremendous work it is accomplishing, and have you really understood what those peculiar long bodies are and what an important part they play in the dispersal of this plant, and hence in the increase of tillable land in the tropics, for this unassuming plant is a great land builder — how I will attempt to show later.

To fully understand what the plant is doing, we must first understand the plant itself. A native of the lowlands of its home, where it is always warm, this plant seems to have no seasonal

activity, but to be always growing, so that flowers and fruit may be found upon it at almost any time. If you will examine the flowers you will find that they have four sepals and petals, and present an appearance not unlike many other flowers with which you are acquainted.. But look further, and you will find hanging to the tree numbers of club-shaped bodies six to eight inches long, or even longer, in the manner shown in the fourth illustration of this article, where in the higher branches these may be

FIG. I. Showing hypocotyls and mangroves in various stages of development.

clearly seen. It is these odd bodies which are peculiar to the mangrove, and which lend to it its great interest, but what are they? They are really young plants, for the seeds of the mangrove germinate while still in the ovary, the developing embryo finally bursting through the apex of the ovary and producing these long club-shaped bodies, known to botanists as hypocotyls. It is not the hypocotyl which is peculiar to the mangrove, for this is found in all young plants, but it is the great and unusual

development of this organ, while still attached to the tree, which is peculiar. At the small end of these peculiar bodies is the plumule, where are concealed the first leaves of the plant, while the other end of the hypocotyl is much enlarged.

Now what happens when the young plant has reached that stage in its development when it separates from the parent tree? The mangrove, as has been said, grows along the shore, and the pendant hypocotyl, when it breaks from the tree, falls, as would

FIG. 2. A well-developed colony extending itself into the water.

a plummet, the big end down. If the water under the tree be shallow, and even eighteen inches would not thwart its object, these bodies penetrate the mud in an upright position and soon take root, sending forth their leaves and in a short time developing into vigorous plants. If, on the contrary, the water be too deep, they rise to the surface after their plunge and float about, for they are lighter than the water, at the capricious whim of tides and winds. In time some of them find a resting place on

a congenial shore, perhaps after tortuous and devious journeyings, and form the basis of a new colony. This is well shown in the first illustration, where a number of these plants may be seen in the hypocotyl stage. To the left is a young one firmly attached to the soil and beginning to grow, while in other parts of the picture will be found other plants in various stages of development. This colony increases until a condition represented in the second picture is reached. Here we see the network of roots,

FIG. 3. Interior of a mangrove swamp, showing interlacing roots.

to which reference will again be made, and also the long gaunt roots descending from the spreading branches. It is these descending roots which extend the zone of the mangrove further and further into the water. Imagine this process to have continued for a number of years, then let us enter one of these mangrove swamps, and we would see before us a vast tangle of arching and interlacing roots, as represented in the third illustration, the surface of this entangled mass being two to three or

four feet above the slimy ooze below. And what purpose does this vast sieve-like mass effect? As the tide rushes in it bears with it masses of decaying vegetable matter and detritus of various kinds, which, when the tide runs out, is in large part left behind. These, added to the decaying leaves which are constantly dropping from the trees above, at length build up a slimy bottom, which, eventually rising above the water, in time becomes solid ground and fit for agricultural purposes. The continuation of

FIG. 4. Rear of a mangrove swamp, showing its recession from the dry land.

this process at last leads to the undoing of the mangrove itself, for, being a lover of the water or of wet places, it finds the new conditions uncongenial and begins to recede, thus vacating the land which it has itself built up, and adding largely, year after year, to the soil available for the purposes of man. In the fourth illustration this stage of the development is depicted. Here may be plainly seen the receding mangrove and the intervening strip of barren land between it and the distant hillside, where the

colony first found a congenial foothold, and from which it has been forced by conditions of its own creating. This barren strip will soon be utilized by man for the growing of crops, and, indeed, the process has already begun, for at the very base of the hill may be seen a small plantation of bananas.

The illustrations accompanying this article were made from photographs taken by the writer on his last journey to Haïti in 1905, and were secured about eighteen miles to the westward of Cap Haïtien.

Here then we have the story of the mangrove. One hardly realizes as he stands looking at the fringe of one of these swamps that a great work is being slowly but irresistibly carried on year after year. Nor does he fully comprehend how well adapted this plant is to its work, until he studies carefully the structure of its fruit, and its method of forcing itself into the domain of the waters, thus transforming them to the uses of mankind. This work is going on in many parts of tropical America through the agency of the plant known to botanists as *Rhizophora Mangle*, a name given to it by Linnaeus in 1753. In other parts of the world are other species of the same genus carrying on the identical work, so perhaps the magnitude of the result may be realized. Not only is the mainland extended by this plant, but islands are formed by it. Some of the floating hypocotyls become stranded on reefs or in other shallow places. At first we have perhaps but a single plant, such an one as is represented to the left of the first illustration. This in time forms its network of roots, catching and retaining detritus, and finally is formed a small island, which continues to grow as long as the mangrove can find congenial surroundings. In the shallow waters surrounding the keys of south Florida many islands have been built up in this way, and these in all stages of development may be seen there now.

There are other land-builders in the tropics, such as the minute coral animals, but perhaps none can excel the mangrove in this work, and certainly in none is the process more apparent.

REVIEWS

Sturgis's The Myxomycetes and Fungi of Colorado*

This paper is No. 1 of a series by Ellsworth Bethel and William C. Sturgis, entitled "The Myxomycetes and Fungi of Colorado." In the series it is intended to cover the mycological flora of Colorado, including the Rocky Mountain region, which hitherto has been largely neglected by mycologists. In the present paper nearly one hundred species and varieties of Myxomycetes are described. Preceding the descriptions are brief notes on life history, collecting and preservation, microscopic examination, and literature. It is intended that the paper may serve as a beginner's guide, and the key is based upon the synopsis of the orders and genera in Lister's *Monograph of the Mycetozoa*.

C. STUART GAGER.

Hanausek's Microscopy of Technical Products †

This work is the result of the many years of labor of the distinguished expert, investigator and teacher, Dr. Hanausek, analyst of the Governmental Food Laboratory at Vienna. After a brief introduction on the use of the microscope and microchemical reagents, the authors discuss in nine chapters the following commercial products: (1) starch and inulin; (2) vegetable fibers, under which heading attention is also given to the examination of paper; (3) animal and mineral fibers and textile fabrics; (4) stems and roots; (5) leaves; (6) flowers; (7) fruits and seeds; (8) teeth, bone and horn; (9) microchemical analysis for various acids and minerals.

The book is designed as a guide to the student entering the field of technical microscopy and aims to familiarize him with the methods of investigation and to prepare him for independent work. It teaches the technical worker how to investigate microscopically commercial raw materials with reference to their com-

* Sturgis, William C. The Myxomycetes of Colorado. Colorado Coll. Publication. Gen. Ser. No. 30. Sci. Ser. 12: 1–43. Colorado Springs, Colo., 1907.

† Hanausek, T. F. The Microscopy of Technical Products. Revised and translated by Andrew L. Winton, with the collaboration of Kate G. Barber. Pp. xii + 471. *f. 1–276.* John Wiley and Sons, New York, 1907. $5.00.

position and suitability for technical purposes, thus enabling him to reach practical conclusions. The origin, harvesting, preparation and utilization of material are also briefly considered whenever the methods of preparation have an influence on the structure of the raw material.

The English edition has been improved by the introduction of over forty new cuts. The drawings by Winton and Barber are a decided improvement over many in the original work which are occasionally so diagrammatic as to be almost misleading. Note should also be made of the very considerable additions to the chapter on textile fibers and of the discussion of commercial timbers which has been revised and extended so as to include the most important North American species.

Noteworthy features of the book are the citations of the literature dealing with the various topics treated and the attention that is given to the solution of purely practical problems. Mention should also be made of the discussions of the more important morphological and biological features of the various organs and structures studied so that the student begins his examination of the commercial products with an understanding of the nature and origin of the various cells and tissues with which he is dealing. While in some minor respects this treatment is not in accord with present day botanical teaching, it will be conceded that the presentation has been made with a clearness and conciseness of statement and with a simplicity and consistency of terminology that may well serve as models for future authors.

Considering the range of the work, the authors have been remarkably successful in handling the various topics and have furnished to technical microscopists a timely and valuable textbook.

CARLTON C. CURTIS.

PROCEEDINGS OF THE CLUB

FEBRUARY 26, 1908

The Club was called to order at the Museum of the New York Botanical Garden at 3:45 P. M. Ten persons were present.

After the reading and approval of the minutes of the preceding

meeting, resignations were read and accepted from Mr. W. H. Liebelsperger, Mr. J. Charles Roper, Mr. James Walker, Mr. George Wirsing, and Dr. H. E. Hasse. These resignations were accepted by the Club.

The scientific program consisted of two papers, of which the authors have submitted the following abstracts:

Remarks on the Genus Boletus. By Dr. William A. Murrill. This paper will be published in the March (1908) number of TORREYA.

Some Fern Hybrids. By Mr. Ralph C. Benedict.

The object of this paper was to present general facts regarding fern hybrids, to indicate the apparent significance of the facts, and to show examples of some native hybrids.

The literature on the subject seems to be very scanty, and consists principally of scattered descriptions of natural and horticultural hybrids. Lowe (Fern Growing) has given a general discussion of the subject but his work is of a horticultural, rather than of a scientific, value. The most conclusive experiments are those carried on by Miss Margaret Slosson, in which she reproduced culturally *Asplenium ebenoides* (*A. platyneuron* × *Camptosorus rhizophyllus*), and *Dryopteris cristata* × *marginalis* Davenport, two suspected hybrids, which occur in nature. Recently at least one more cross has been artificially produced by Mr. Amedee Hans, of Stamford, Ct., between *Dryopteris Filix-mas* and *D. marginalis.* This, however, has not yet been found wild.

Study of these three authenticated hybrids shows that they agree in general with the hybrids of some flowering plants. They are sterile, usually larger than the parents, sometimes abnormal, and in many characters intermediate to a greater or less degree between the parent species. In view of these facts, it seems reasonable to interpret as hybrids other forms (principally in *Dryopteris*) which are sterile and similarly intermediate between two species.

Some of these are very characteristic and might be considered separate species. At least two have been so described. This view, however, is untenable because of their sterility, and their distribution, rare or occasional with the parent species, or at least

in a locality where these grow or have grown. That they are mutations seems very doubtful, because the actual differences are so great, and especially since in these differences they resemble the other reputed parent. For example, sterile intermediates are known between *Dryopteris marginalis* and six other species. Some resemble *marginalis* most, some the other species, but all agree in possessing distinctive characters of each of two species. For similar reasons, these forms cannot be satisfactorily explained on ecological grounds.

If it is objected that fern hybrids must, because of the conditions required for the transference of spermatozoids, be too rare to account for these plants, which are rather common, it may be said that *Dryopteris cristata* × *marginalis*, one of the authenticated crosses, is perhaps the commonest of them all. It may be expected in any swampy woodland where the parent species occur. This being the case, we are bound to expect the other forms to be found at least occasionally, and it seems only logical to conclude that such intermediate sterile forms as are analogous in general characters to *D. cristata* × *marginalis* belong in the same category and are likewise hybrids.

In the region in which the writer has studied these plants, *Dryopteris* is represented by six specific units which seem to hybridize more or less readily, representing a total of fifteen possible combinations of two species. Of these fifteen, two are already described. Of the remaining, probably eleven have been found, and descriptions for most of these are in preparation, some by Miss Slosson, some by Dr. Philip Dowell, and some by the writer.

Both papers were discussed at length, and the Club adjourned at 5:45 o'clock.

C. STUART GAGER,
Secretary.

MARCH 10, 1908

The meeting was called to order at the American Museum of Natural History at 8:30 P. M. by the Chairman of the program committee. There were twenty-five persons present. In the absence of all officers of the Club, no business was transacted. The scientific program consisted of an illustrated lecture entitled

"On horseback through Hayti," by Mr. George V. Nash,* and was listened to with great interest by all present.

Adjournment was at 9:45.

TRACY E. HAZEN,
Secretary pro tem.

OF INTEREST TO TEACHERS

The sixth question suggested in the March number has enlisted many interesting letters. This issue contains but part of them; other letters referring to this and to the remaining questions will be printed later in TORREYA. The wide range in the letters is in itself suggestive.

The question here discussed is:

Why does not the study of botany more often create a lasting interest? Would this be secured by more emphasis on morphology, including classification?

Perhaps one reason more lasting interest is not secured is because there is so little that even the interested high school pupil can do by himself after completing his half year or whole year course in botany. Reading alone will not serve as in history, literature and foreign languages. The second part of the question was added with this difficulty in mind.

I

The following is a qualified answer for I do not feel that I can answer the question for more than the students under my own observation.

For boys of the age when they come to the De Witt Clinton High School (13 to 15), I believe the more laboratory physiology or perhaps I should say the more simple experimental work and demonstration we give in elementary, physical, chemical, and biological science, the greater the interest. Things morphologic or taxonomic seem to gain and hold interest with but few; modifications and adaptations in structure interest more students; simple experiments with a definite problem put before the student

* Instead of the usual abstract Mr. Nash has written a short article on the mangrove which appears upon another page; other interesting accounts of the same trip are to be published later in TORREYA.

to be worked out at home or in the laboratory almost never fail to gain interest and coöperation from our students.

GEORGE W. HUNTER.

DE WITT CLINTON HIGH SCHOOL,
NEW YORK CITY.

II

One reason that the interest aroused by the average high school course in botany is not deeper and more lasting is that we try to cover too much ground and touch upon too many topics. If a young person is to follow a subject for his own pleasure he must feel to a certain extent that he has command of it. The mountain view is certainly broader and contains more that is interesting, but one feels no sense of possession and there is no starting point for activity.

One teacher when questioned looked up in surprise and said, "We teach only the fundamental principles as it is!" Where do "fundamental principles" end and can they all be taught in a course covering half a year to pupils who are strangers to science and who are only children? Botany itself is divided into half a dozen sciences; why not divide the "fundamental principles" similarly and try to teach only *one* branch. Any attempt at condensing a subject usually results in cutting out the most interesting part and leaving the dry bones.

It would seem that the question as to whether this narrower, more intensive course shall be mainly physiology, morphology, or classification, must depend upon the teacher, the pupils and the environment. As to classification, I would add that it is the department of botany which can most easily and most naturally be followed in an irregular way by a person with little preparation, a small outfit and odd minutes. But whether in any given school a course of that kind can be given with advantage, each must decide for himself.

STELLA G. STREETER.

JERSEY CITY HIGH SCHOOL.

III

To the first question I should be inclined to say that all our botanical courses and text-books intended for high schools are too technical, philosophically morphological and scholastic for high

school use. They are all written by technical botanists who have forgotten that they were ever young themselves. They are all much more "complete," difficult, and fatty-degenerated with unessential detail than their authors ever tackled in their own college courses. All this is apart from any vital human interest, and, naturally enough, the pupils, when they pass their examinations, lay it aside with a feeling of relief.

The old classification-key-analysis botany of two generations ago has died a natural death, as the little knots of grandmothers, who used to gather of summer afternoons to "analyze flowers" — the same ones over and over again — have been laid to rest; and there is neither hope, nor occasion to resurrect it. If I add that I have never been able to discover anything in ecology which could serve any purpose in high school botany other than to make life a burden to the students, we may consider the fringes of the first question sufficiently treated. The main problem: Why not a more lasting interest? would require more time than I, and more space than you, have to spare. But, in a single word, if we hope to awaken interests that shall live and grow with the mental life and growth of the pupil, we must select the matter which has the most vital human interest. In other words, it is absurd to expect everyone to become an enthusiastic technical botanist, but there are certain vital, fundamental, and universal interests in plants out of which technical botany has developed, in which all may reasonably have some share. Acquaintance with common wild flowers and common weeds, coupled with the idea of preserving species in danger of extinction or of exterminating undesirable species, appeals to me as one line of such common human interest. Knowledge of the esthetic possibilities of all sorts of wild and cultivated flowers, vines, shrubs, etc., is another line of perennial and wholesome interest. For this acquaintance work by all means let us have simpler keys, if possible, and let them include cultivated plants. Principles and possibilities of plant breeding is another line of interest well calculated to open up into wonderful botanical pastimes later on in life. Acquaintance work should extend to the algae and especially to the fungi — mushrooms, poisonous and edible, important parasitic forms of forest, orchard,

garden, and field, and the life histories of common household moulds and bacteria. Much of this should coördinate with hygiene, home, and community sanitation, and the great movement for national health ; and, if this is done, there will be no danger of interest flagging after once being kindled.

Local and national forestry problems, timber resources and water conservation and the knowledge of trees in relation to landscape improvement and roadside planting are other blocks of general human interest which the high school course in biology on the plant side should utilize to the full.

All the above suggests making high school botany strongly biological, and this seems to me to be the tendency both abroad and in this country. Physiological botany, excepting a very few fundamentals related to cultivation and plant breeding, I should think ought to await the college and university courses.

C. F. Hodge.

Clark University,
Worcester, Mass.

IV

It is not easy to answer this question in a few words. There may be several different reasons why the subject of botany does not "more often create a lasting interest," some of which may apply with greater force to one school system than to another. It makes a difference, too, in which year of the high school the subject is taught. In what is said below, it is assumed that the course is given in either the first or second year of the high school.

It seems to me that one reason why botany does not arouse a more lasting interest in the pupils lies in the general lack of knowledge on the part of teachers of the nature of the pupils they are aiming to instruct. It is not that the teachers do not know their subject, but that they do not know their pupils. The high school teacher of science fresh from his college training has had no practice in the art of teaching, but this defect time will remedy. He has no adequate knowledge, usually, of psychology, especially child psychology, and without this he is unable to understand the adolescent in his true perspective, as related to the child that was, on the one hand, and to the man or woman

that is to be, on the other. Of course, a teacher soon learns to make many adjustments to the needs and capabilities of his pupils, and, indeed, is forced to do so, but in general the teacher's own college science course is only slightly modified to fit the high school pupil, and the result is a misfit. The high school needs the help of broadly-trained men and women to make its work serve better the needs of its pupils; not only is this true in the science work, but in other lines as well.

Looked at from this point of view the remedy for the lack of real and lasting interest in the botany work would certainly not be to add more morphology. That is quite the worst thing that we could do. Nor would it help to provide more artificial keys for the identification of plants, in the hope of stimulating interest through plant analysis. Neither should I advocate more ecology or more plant physiology, considering these merely as subdivisions of the science of botany.

The remedy lies, it seems to me, more in relating botany to the other life-sciences — zoölogy, including human physiology, particularly hygiene, thus making it a body of organized knowledge of the greatest value and interest to the adolescent. If given in the second year of the high school, it should follow a course in general science, given from an evolutionary and synthetic point of view. There are many problems in connection with such a course. Of these, I may mention three: first, how to bring the work in close touch with the life of the pupil and make it an influence for good, for example, in inculcating the love of out-of-doors, or in affecting personal and social sanitation; second, how to select for emphasis the evolutionary factors or elements which serve to bind the whole into a consistent body of knowledge, eliminating the useless details; and third, how to present this body of knowledge historically, as itself an organic growth now only in its infancy. Were these problems in teaching solved I believe there would be no question as to the practical value of botany, nor as to the interest aroused at high school age, nor as to the permanancy of this interest in a relatively greater number of pupils than at present.

HENRY A. KELLY.

ETHICAL CULTURE SCHOOL,
NEW YORK CITY.

V

The ordinary student in our secondary schools usually receives but one half year instruction in botany. A large part of that half year is generally consumed in learning terms, an uninteresting task in any subject. By the time a working botanical vocabulary is obtained, little of the five months remains in which to find the real meaning of the subject. At the end of the half year, some other branch is substituted for this one and the little that is learned of botany is soon forgotten, while a continuation of the study for another half year might have led a number of students into more lasting sympathy with the subject. The teacher as well as the pupil finds the results of this short period unsatisfactory, and only the occasional student has obtained sufficient interest to lead to a pursuance of the study beyond the classroom.

The entrance to the high school opens up to the student at this formative period in his career a variety of attractive lines of study and possibilities for life work. The boy's leading is usually toward the "practical" studies, as mathematics and the physical sciences, the girl's toward literature and languages, and the assistance of these subjects in earning a livelihood has its effect upon the student's likes and dislikes, as well as upon his choice of subjects in the elective course.

The half year botany is frequently given in the first year when everything is comparatively new. In this crowded period of mental confusion and adjustment, when the student is adapting himself to new methods of study and instruction, its importance to him is lost. Even if given later in the course, it is seldom allowed the importance in the curriculum that other subjects, such as algebra, latin, geometry or literature, have. It is hence considered a minor subject, a study for "girls," as one high school boy expressed it. If required, the student in many cases takes the subject to "pass" it; if elective, because it "sounds easier" than some alternative.

To sum up: The study of botany does not more often create a lasting interest because of —

1. The unfortunately crowded period in the pupil's life when it is introduced.

2. The short amount of time devoted to it when the subject is given; hence —

3. The superficial or technical manner in which the subject is taught.

4. The lack of immediate or close relation to the pupil's life, thought and needs at the time when it is introduced; hence not sufficient interest is created for that interest to be lasting.

Although these conditions exist in many localities, in others they are being partially met by the introduction of plant study into the elementary schools. When the child, unaccustomed to some plant study earlier in his school life, begins his half year of botany in the high school, he must spend time in learning what to see and how to see it, as well as the application of the terms required. The child, accustomed to the observation of a plant in the elementary school, has already learned to see, at least in an elementary way; he has learned a few necessary terms; he has gained a foundation upon which to build his half year botany. He takes up the subject, now to be treated more technically, with an interest already created, and is ready to add to this foundation built in a natural way.

The introduction of the microscope before the student has learned to use his powers of observation with the unaided eye, the use of alcoholic and dried specimens with the beginner, and the study of plant parts without first considering the plant as a whole, all tend to deaden an interest that should continue beyond the botanical classroom. An intimate acquaintance with a few plants made in a proper manner and an introduction by name to as many plants as possible will place at the student's disposal a basis for continued interest.

For a few years past, I fear we have swung the pendulum too far from the value of the name of an object. The child, or ordinary grown person for that matter, wants a name for the thing at hand. He will recognize no other introduction. Further acquaintance may prove desirable, but he must first have the name. Therefore, I make a plea for means of simple classification leading to common names for common things. What's in a name? It may be the entire interest in a subject; at least, the

lack of a name may cause a plant to go unnoted a long time, while the name alone may lead to further acquaintance never otherwise obtained.

Simple keys for tracing trees, flowers, etc., including the common cultivated plants, will take away one of the greatest drawbacks to finding the name of a plant, that is, the knowledge of difficult technical terms and the dependence of a determination upon some seasonable condition distinguished with difficulty.

Therefore, to create a more lasting interest in botany:

1. Introduce the subject earlier in the pupil's life.

2. Let the required amount of time given to introductory work be increased.

3. Have the basis for study comprehend a few types, including some closely related to student's life.

4. Learn by name as large a number of plants as possible.

LAURA WOODWARD.

HEWITT TRAINING SCHOOL,
TRENTON, N. J.

Symons's Monthly Meteorological Magazine for November, 1907, describes a unique hygroscope designed by John Aitken. The petal of one of the so-called everlasting flowers is attached to a stiff hair, which serves as a pointer, and the petal and hair together are fastened on a dial, set in a metal case. The instrument is about as sensitive as a hair hygroscope, but more compact and cheaper.

The Committee on the College Entrance Option, Professor W. F. Ganong and F. E. Lloyd, presented a report at the second annual meeting of the federated societies (the fourteenth of the Botanical Society of America), held in Hull Botanical Laboratory, at the University of Chicago, December 31, 1907. The committee recommeded that a somewhat revised fourth edition of the high school course now used as a basis for the college entrance examinations in botany be printed, and that the committee confer with the American Society of Zoölogists in formulating a high school course in biology.

The "birds-eye maple" is discussed in *Science*, March 27, 1908. The solution of Dr. A. W. Borthwick, of Edinburgh, is

given, and another theory * as to the origin of these peculiar markings is added to those already known. Dr. Borthwick thinks that this peculiarity is due to the formation of adventitious roots upon the stem, and that these arise from abnormal medullary rays. In none of the cases examined (with possibly one exception) were such roots due to mechanical injury, or the attacks of fungi or insects. While the conditions which govern the production of adventitious roots are not certainly determined, he is sure that moisture is an important factor, as it is "only in the moistest situation that they persist for any time after they pierce the periderm."

NEWS ITEMS

Mr. Norman Taylor, who has been an aid in the New York Botanical Garden for several years, has been appointed custodian of the garden plantations.

Ira D. Cardiff (Ph.D., Columbia, 1906), professor of botany in the University of Utah, has been elected president of the recently organized Utah Academy of Sciences.

Mr. A. K. Chittenden has been appointed assistant in the U. S. Forest Service to investigate the White Mountains and the Appalachian Mountains in regard to the proposed national park.

* *Ackerman's Repository*, an old English journal of "Arts, Literature and Fashions," published in 1825 an article on "Botanical Theory" which is interesting in this connection. The italics are ours. "This marking is an excellence not peculiar to any one tree, but is occasionally met with in the maple, citron, yew, ash, beech, lime and other trees. A knowledge of the particular time when trees may be expected to exhibit such figured appearances, seems to have been a secret confined to very few, who, by thus having the command of the market, contrived to keep up the prices. To the discovery of this secret, the fair botanist [Mrs. Ibbetson] has been led by her researches in support of a theory which she has the honor of *originating*: namely, that the buds of trees *ascend* from the *root*. Willdenow thought that they were formed in the bark; Mr. Knight says that they originated in the alburnum next the bark. 'Pliny's description of the *bruscum*, so prized by Romans in their tables,' says Mrs. Ibbetson, 'immediately brought to my mind the different figures of the roots of various trees, when cut down at the proper season, for this does not last above a fortnight or three weeks at most in any tree; but if taken within that time, most roots form a very beautiful picture.' This she contends may be attributed to the various grouping of the buds, as they are about to *start*, or have *started*, from the *root* on their progress up the different layers of the wood to the exterior."

The University of Iowa has received from Mrs. L. V. Morgan the botanical collections of her husband, the late Professor A. P. Morgan. The mycological specimens in the herbarium are very valuable, because of Professor Morgan's own work in that line.

Mr. M. Rothkugel, of the U. S. Forest Service, has gone to Porto Rico for three months, to study the conditions there, and to outline a course of management for the Luquillo National Forest, the only insular national forest belonging to the United States.

The new Pacific Scientific Institution which has its headquarters at Honolulu is planning extensive explorations of the Pacific Ocean for the next fifteen years. The work in botany will include the establishment of an acclimatization botanical garden in Hawaii.

The fifth annual field "symposium," in which the Philadelphia Botanical Club, the Washington Botanical Club, and the Torrey Botanical Club will coöperate, will be held at Georgetown, Delaware, July 6 to 12. Particulars as to headquarters, etc., will be announced later.

Professor Herbert F. Roberts, of the Kansas State Agricultural College and Experiment Station, has been commissioned by his home station to spend the summer inspecting the wheat regions of central and southern Europe in search of superior sorts of hard wheats for introduction into Kansas.

The centenary of Darwin's birth is to be celebrated at Cambridge, England, in 1909. A chair of biology is to be established, partly through the anonymous gift of £300 a year, which is contributed upon the condition that the professor shall either teach or make researches in heredity.

Mr. C. G. Pringle, keeper of the herbarium of the University of Vermont and the veteran botanical explorer of Mexico, is planning to make an expedition to South America in the near future. He intends to go by way of Mexico and Panama and expects eventually to reach the Andean region of Colombia and Ecuador.

TORREYA

May, 1908

Vol. 8. No. 5.

BOTANY.*

By Herbert Maule Richards.

As you have heard in previous lectures, there is an increasing tendency on the part of biologists to segregate less sharply the physiological and morphological fields of work, to take a broader view not only of the content but also of the methods of the two branches of biological investigation. It must not be supposed, however, that in this tendency towards coöperation there is a return to omniscience of the type of the old-time naturalist, who by reason of the lack of detail was able to consider himself proficient in many branches of science. The modern morphologist must still be a morphologist, and the physiologist a physiologist, only he has a broader point of view and does not hesitate to avail himself of the cognate branches of his science, or of any other science, where he feels that he can further the aims of his researches; he is an eclectic and picks that which will serve to advance his work along the most fruitful lines.

Almost any investigation of wide scope is in these days an example of this improved attitude, but no other perhaps illustrates so conclusively what may be called the highest type of modern research as does the development of the Mutation Theory first propounded by de Vries. What de Vries has really done is to bring within the range of experimental proof certain questions which heretofore have been regarded as matters of observation and speculation alone. From this point, which might be said to have had its origin in the acuteness of observation of the taxonomist and morphologist, the physiological trend has

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ever increased until the last word in this discussion may perhaps be for the physiologist alone. The great question involved in the Mutation Theory is the old, old problem of the origin of species, a very considerable advance in which has been made by de Vries and those who were stimulated by his work. It is quite wrong to suppose that he has controverted the general results of Darwin's work; he has supplemented it, brought it within the range of more conclusive proof.

As the Linnaean or collective species may be regarded to-day they are usually separable into several more or less distinct strains which show no intergrading forms, and the diagnosis of any one species is, so to say, the average impression of them. To these distinct strains de Vries has given the name elementary species, and according to his interpretation they are the really discrete, finally segregable units, between which no intermediate types exist and concerning the origin of which we are really concerned. It matters not whether it was through ignorance or simply from convenience that the earlier taxonomists grouped many of these forms into a single species; we must conclude, that in general species, as recognized by the books, are quite artificial. It matters not, also, what we call these finally not further resolvable forms. Therefore let us accept de Vries's terminology and use the term elementary species; the real point of the inquiry is how did these forms arise. It is upon this that de Vries's work has thrown a great light. He has shown that they may arise suddenly and without previous preparation from preëxisting forms, in which case the elementary species may be termed mutants, and the theory which has to do with the investigation of their origin the Mutation Theory.

The next task then is to examine more closely the methods which de Vries employed, the evidence which he has to support his views, both as to the observations on the origin of these mutants and their behavior after they have come into being, and further, what success subsequent investigators have had in supporting de Vries's evidence, and how far they have extended his conclusions. In the first place, it may be remarked that the conclusions as first published in 1901 and 1902 were not the

outcome of any hasty experiments and ill-digested data, but were the result of seventeen years of the most careful and painstaking work, and a fine example of the best kind of quiet, faithful research, removed from the rush of affairs and the demand for immediate results, the final conclusion of which fully warranted the time and labor expended.

As is well known, Professor de Vries found in Lamarck's evening primrose—*Oenothera Lamarckiana*—a plant most favorable for observation, though his conclusions are not based on that form alone. The most carefully guarded pedigree cultures were made from the true *Lamarckiana* type, and the astonishing result developed that among the offspring of these certain forms, to the number of about 4 per cent., showed new and striking differences. In all, more than a dozen new forms were obtained which, if they could be bred at all, bred true to their new characters and did not revert to the ancestral *Lamarckiana;* these were the mutants, the new elementary species, which had sprung suddenly in a saltatory fashion from the parent stock. The great importance lies in the fact that they were entirely constant to their new characters and were thus not in the class of the merely unstable varieties. It must be remarked that time alone, many generations, of carefully guarded cultures in which accidental crossing was an impossibility, together with unimpeachable records, could adequately establish this momentous fact, that here was a new species, a new form, or whatever you may elect to call it, which had sprung all in one jump from its parental stock. De Vries, then, was the first man who ever saw a new type of organism come into the world and who recorded its advent.

You naturally ask how unlike were these new forms, a question which is difficult to answer without actual illustrations. However, it may be said that many of them were different enough from their parent stock to be admitted by taxonomists to come within the definition of new species, as species are regarded at the present time. The differences are not the question of mere stature, but of the whole habit of the plant and of the details of the form of both leaves and flowers. But to repeat, it really makes no odds

whether the differences are of such quality that they must needs be recognized as specific by taxonomists; what is important is that they are differences which do not intergrade one with another and which are inheritable in the second, third, and subsequent generations, and that no tendency to revert to the parent form is to be observed.

The results of de Vries have been verified by cultures in this country of his own and of other stock, so that there can be no question that this Lamarck's evening primrose behaves in its manner of mutation the same here as elsewhere. More than that, other mutating forms have been discovered, and by the application of biometric methods much that is important regarding the relative variability of mutants and their parent stock has been determined. Besides the actual experimental work, the history of Lamarck's evening primrose has been traced back for more than a century and a mass of inferential data is being accumulated which helps to support the main conclusions. Important as all these advances are, the most brilliant result is that obtained along the lines of the induction of mutations. By injecting into the developing ovary of a plant allied to Lamarck's evening primrose reagents which might produce a chemical or osmotic effect upon the cell contents, MacDougal has actually succeeded in inducing mutations. The seed grown from the stimulated plant may produce forms quite distinct from the parent type and, what is essential, the mutations thus induced are constant to the second and third generations. That such a result can be obtained is simply astounding when one considers how firmly an organism is bound by its heredity. It would appear that a tremendous shock had been given the plant at a critical period in its life history which has enabled or forced it to break down some of the minor barriers imposed by its hereditary tendencies and to erect new ones, which circumscribe its offspring as the original ones did its parent. As to the precise nature of this shock we can at present only speculate, but it is permissible to suggest that it is perhaps of the nature of the rearrangement, in a chemical sense, of the protoplasm of the cells of the sexual generation. As to the natural production of mutants, given such a conception of the nature of the process

involved, it is possible to suggest various ways in which it might have been brought about.

The line of departure of mutants from the parent type is not in any one direction, and the manner of variation appears to be wholly a matter of what we are pleased to call chance. As has been said, de Vries obtained more than a dozen different forms. Some of the mutants, we may say, are probably destined to failure, others perhaps are better placed, at least in new environment, than the parental type and might conceivably stamp it out in time. What the criteria of success or non-success may be is a matter upon which no one would care to give an opinion, but I have in mind the fact that one of the mutants of Lamarck's evening primrose has a tendency to germinate somewhat more quickly than the parent form, and the seedling grows a little more rapidly; it is conceivable that some slight advantage of this sort might be the crucial point. However that may be, it is here that we can apply the Darwinian concept of the struggle for existence, a struggle however not between single individuals, as the idea of continuous variation would imply, but the struggle between great numbers of individuals, whole groups of elementary species. The great contrast between Darwin and de Vries is the contrast between the slow and continuous accretion of variations implied by the former and the sudden jumping or saltatory variation insisted on by the latter. By such means as de Vries maintains the process of evolution might take place with far greater rapidity than by Darwin's method, for, generous as the geologists are in their allowance of time for the development of organic life on the world, it has always been difficult of conception how even the countless ages granted could compass the enormous development of the highest organic types from simple forms. To maintain that de Vries's theory is entirely complete, and must be the only means of the origin of new forms, is unnecessary. None but the extremists would go to such a length; it is not at all necessary to assume that the means to a similiar end must necessarily be similar. What may be maintained, and properly so, is that mutation constitutes one way, at least, by which new forms of organisms may arise on the world's surface. New forms, in the

sense of the new combinations of old characters which come into being by reason of stable, non-reverting hybrids, are known to have originated, but such new forms imply of course the preëxistence of varied types, and do not have to do with the question of the origin of new characters.

It is not in the order of things that a new theory of such import as the Mutation Theory should not find opponents. These I think may, in the main, be grouped in three classes. First, the critics who doubt the evidence, who can be answered by referring them to the printed records, and recommending a repetition, as careful as the original work, of the experiments which have led to the new point of view. Second, those who quibble concerning terms, and this type I think constitutes the majority, who will likely suffer the fate that is usually meted out to quibblers, that of being ignored. Lastly, those opponents who, while they may not doubt the accuracy of the work doubt the conclusions on philosophical grounds. These are the critics whom the advocate of the de Vries Theory must welcome and who will arrest his sober attention, for they will stimulate him to accumulate more and more evidence to support his position. Even were I able to analyze adequately the controversial side of the question for you, it is obvious that time scarcely allows, and I will, in consequence, state frankly that the account which I have presented is from the standpoint of an advocate of what the Mutation Theory teaches, and add that I am not aware that any experimental work has controverted it. Let me say, however, and here I wish to speak for myself alone, that I cannot see it makes great odds whether fifty years hence or five years hence we accept the Mutation Theory just as propounded by de Vries. The great point is that an advance has been made, the most important advance since the time of Darwin, by way of helping to elucidate one of the great questions in which man is interested. It is not to be supposed that we have as yet any final answer to this question; final answers are not indeed the goal of any one scientific research. It was Sir Isaac Newton, I think, who said that the seeker after ultimate causes did not show the true scientific spirit, and he was right. What we have is one of the proxi-

mate causes demonstrated to a degree which had not been previously attained. A scientific theory is like an organism, it grows and it may also propagate itself, and all the theories of evolution from Lamarck to de Vries, and those that will follow, will themselves be an example, as it were, of the principle that they teach. A theory which starts life an intellectual pigmy, may develop, if it have the vitality, into a veritable intellectual colossus, and, after it has run its course, may leave behind its offspring. It is not a cause of reproach but rather of congratulation that the scientific theory of to-day may be discarded to-morrow, for no theory will be abandoned until a better one has been brought forward to take its place, one which can explain the facts in a way more satisfying to the human mind. Change in such a case is progress, and since science must of necessity be always progressing so also must it be always changing.

To those who are conversant with the problems connected with the origin of species, it must be obvious that this consideration of the subject does not cover the whole ground; so obvious, indeed, that perhaps it is unnecessary for me to remark that it is not intended to. There are other theories to be considered and other equally important matters that are more or less interwoven with any one theory of the evolution of new forms. Thus no reference has been made to Mendel's researches on heredity, or the way in which they touch upon the de Vries Theory. This has been omitted purposely, for while the results of Mendel's original experiments in the breeding of peas might be cited at length, I doubt if an apter or more significant example could be found than the one which Professor Wilson used, and as Professor Wilson himself said, the explanation while not abstruse is one that requires considerable preparatory consideration. The Mutation Theory has been developed more in detail, as representing a type of research. Being one of the latest and most important contributions to biological science, and being also entirely germane to the subject in hand, it has seemed proper to devote some time to its consideration. At many points do the fields of modern botany and modern zoölogy touch, but perhaps it is nowhere so evident as in great problems like these. Here

the two sciences work in generous rivalry, each eager to add its contribution to the store of general knowledge, to utilize such information as the sister science brings, to criticize it if need be, but always to accord it a respectful hearing.

(*To be concluded.*)

STUDIES IN THE OPHIOGLOSSACEAE—II

A Descriptive Key to Botrychium in North America: Group of B. lanceolatum

By Ralph Curtiss Benedict

The present treatment is designed to set forth briefly the essential facts of our knowledge of these plants from a taxonomic standpoint. The status of the various units included is not considered. The question of specific limits is a perplexing one throughout the genus, and one which will probably require cultural work, such as the raising of the various forms from spores, and under varying ecological conditions, to settle it satisfactorily. But additional information gained from field and herbarium study will be of value, and any corrections and additions to the account given will be welcome.

For convenience, the genus may be divided into two groups, typified in general by the species *B. lanceolatum* and *B. ternatum*, respectively, and characterized as follows:

Group of *B. lanceolatum:* Bud hairless (*B. virginianum* excepted); commonstalk one-half or more epigean (*B. pumicola* excepted), usually one-half or more the height of the plant (*B. simplex* excepted); spores maturing from late spring to early summer (May to June). Included in this group are the following: *B. simplex* Hitchcock, *B. pumicola* Coville, *B. boreale* Milde, *B. onondagense* Underwood, *B. Lunaria* (L.) Sw., *B. tenebrosum* A. A. Eaton, *B. neglectum* Wood, *B. lanceolatum* (Gmel.) Ångstr., *B. virginianum* (L.) Sw., *B. dichronum* Underwood.

Group of *B. ternatum:* Bud hairy; commonstalk hypogean, short, usually less than one-quarter the height of the plant; spores maturing from the middle of summer to early fall (July to October) (three exceptions).

The above grouping is probably a natural one, but the proper rank of the two groups and their relationship to each other are problematical. The plants included in the first division fall naturally into three or four evolutionary series, starting in each case from the simplest species in the genus, very appropriately *B. simplex*. But this species may also represent the origin of the second group, and some writers have preferred to place it in this section because of its short commonstalk, and occasionally subternately divided lamina. However, it is surely more closely related to species in the first group, notably *B. tenebrosum*, through which it is connected with other forms of the same general type. No real connecting species is known between *simplex* and the species of the *ternatum* group. The latter form a unified and natural section and have even been given generic rank, but on insufficient data. H. L. Lyon * noted a considerable difference in the development of the young sporophyte of *B. obliquum* on the one hand, and of *B. simplex*, *B. neglectum*, and *B. virginianum* on the other. This difference is interesting, but it cannot be considered of value, even to separate the groups, unless it is shown to be constant for other and diverse species in both groups.

Two other groupings of the species have been made. Milde recognized two subgenera, *Eubotrychium* and *Osmundopteris*. The latter included only *B. virginianum*, and was based on a very artificial character, the fact that in this species, the bud-sheath is partly open. Prantl divided the genus into groups nearly like those used here, but differed in placing *B. virginianum* with *B. ternatum* and others of that type to form his subgenus *Phyllotrychium*, of which the principal distinctive character is the possession of a hairy bud. But *B. virginianum* seems to find its closest affinities with *B. lanceolatum*, and it is more reasonable to suppose that it represents an extreme development of this type than to relate it to the much more different *B. ternatum* group.

In the key that follows, the difficulties in connection with the two smallest species, *B. simplex* and *B. pumicola*, are met by giving descriptions sufficiently complete to prevent the confusion of mature specimens of other species with these, but it is prob-

* Bot. Gaz. 40: 455–458.

ably impossible to draw up a synopsis or descriptions which will differentiate the very young and immature forms of *B. simplex* from similar forms of *B. tenebrosum* and *B. matricariaefolium* and perhaps others. The identity of such forms can usually be ascertained from the mature plants associated with them. As regards the most closely related units, these are in each case keyed out in pairs, so that doubtful specimens may be traced at least to one of two.

Commonstalk about one-half hypogean, the lamina straight in vernation, entire to once or twice pinnately or sometimes subternately divided into cuneiform to lunulate, usually separated segments; the sporophyl straight in vernation, long-stalked, often one-half to two-thirds the height of the plant (in meadows and pastures, northern North America, Europe, and Asia). 1. *B. simplex* Hitchcock.

Commonstalk all or nearly all hypogean, lamina with the tip bent down in vernation, once ternately divided, the divisions pinnately divided into cuneiform to lunulate, crowded segments; the sporophyl erect in vernation, short-stalked, scarcely exceeding the lamina (in pumice soil, 9000 ft. elevation, Oregon). 2. *B. pumicola* Coville.

Commonstalk nearly all epigean.

Lamina oblong to ovate or narrowly deltoid, with only the tip or upper part bent down in vernation; the sporophyl erect or with the tip bent down.

Lamina with the tip bent down in vernation, but not clasping the sporophyl, ovate to deltoid, acutish, sessile, usually only once pinnately divided, the segments rhombic to deltoid, acutish (Alaska, also in Europe). 3. *B. boreale* Milde.

Lamina with the tip bent down in vernation and clasping the sporophyl, oblong, rounded, usually sessile or nearly so, only once pinnately divided with fan-shaped to lunulate segments.

Plants usually slender, lamina narrowly oblong, the segments fan-shaped, distant (central New York, northern Michigan, and Montana). 4. *B. onondagense* Underwood.

Plants usually stout, lamina usually broader, the segments lunulate, often close and imbricate (northern North America and Europe). 5. *B. Lunaria* (L.) Sw.

Lamina with the tip or upper part bent down in vernation and clasping the sporophyl, oblong to ovate or sometimes deltoid, usually stalked, entire to twice pinnately divided with cuneiform, oblong, or ovate segments.

Segments mostly cuneiform; sporophyl erect in vernation (in wet woods, northeastern states and Canada). 6. *B. tenebrosum* A. A. Eaton.

Segments mostly oblong or ovate, the sporophyl with the tip bent down in vernation (usually in dry ground at the edge of woods and thickets, northern North America and Europe). 7. *B. neglectum* Wood.

Lamina broadly deltoid, and, with the sporophyl, entirely bent down in vernation, sessile or nearly so.

Bud smooth, in a closed sheath, plants 5–32 cm. high, lamina 1–6 cm. long, 0.8–9 cm. broad, 1–2 or rarely 3 times divided, the sporophyl short-stalked, about one-fourth the height of the plant, the panicle usually stout and diffuse. 8. *B. lanceolatum* (Gmel.) Ångstr.

Bud hairy, in an open sheath, plants 8–80 cm. high, the lamina 2.5–35 cm. long, 4–42 cm. broad, 3–5 times divided, the sporophyl long-stalked, one-third to one-half the height of the plant, the panicle slender.

Lamina annual, panicle slender (continental North America, also in Europe and Asia). 9. *B. virginianum* (L.) Sw

Lamina persistent for two to four years, the panicle stouter (Jamaica). 10. *B. dichronum* Underwood.

A treatment of this section of the genus *Botrychium* is hardly complete without reference to Mr. Davenport, and his contribution to our knowledge of some species in it and their relationships. His pains-taking work with *B. simplex*, and his discovery and exposition of the bud characters by which many of the species may be certainly identified, will probably always remain, from a taxonomic standpoint, the most valuable additions to our knowledge of this group.

New York Botanical Garden.

COLLECTING LIVERWORTS IN JAVA

By Douglas Houghton Campbell

Two years ago it was my good fortune to spend over three months collecting in Java, perhaps the most interesting region in the world to the botanical student. Wallace pronounced Java to be the most beautiful of all tropical islands, and one who has visited it is inclined to agree with his verdict. Lying as it does only a few degrees from the equator and possessing an exceedingly heavy rainfall and a volcanic soil of extreme fertility, the vegetation shows a luxuriance and variety that far surpass anything I have ever seen in any other part of the world. This great variety is shared by the lower plants, and the liverworts include many forms of the greatest interest.

Java is extremely mountainous, being largely composed of a range of volcanoes, several of which exceed ten thousand feet in height, and there is great difference in the rainfall at various

points, the heaviest precipitation occurring in the western portion of the island where the famous Buitenzorg gardens are situated. This great range of elevation combined with the differences in rainfall results in a marvellously rich and varied flora. It is said that there are over fifteen hundred species of trees in the island, which in area is little if any larger than England.

Much of my collecting was done in the neighborhood of Buitenzorg and on the Gedeh, a mountain upon which is situated the mountain station Tjibodas, where I spent about a month.

Goebel over twenty years ago visited Java and called attention to some remarkably interesting liverworts, among which was the new genus *Treubia*, one of the largest and most striking forms known. Schiffner (Hepaticae der Flora von Buitenzorg. Erster Band. Leiden, 1900) has described the thallose forms, among which are many new species, but he has not yet published a complete list of the foliose liverworts nor of the Anthocerotes. No doubt many interesting forms will reward further explorations.

As in other tropical countries, the greatest profusion of liverworts does not occur in the hot lowlands but in the cooler and very moist mountain districts. Nevertheless, many striking species are common about Buitenzorg, whose elevation is between two and three hundred meters.

My collections were mostly confined to the thallose liverworts, as these were the ones I wished to study especially. The foliose species, however, are extremely abundant and include a great many striking and beautiful forms. Unfortunately the identification of most of these is very difficult.

The botanical garden of Buitenzorg lies but a few miles from the base of a very striking volcanic cone, the Salak, and nearly every afternoon rain clouds gather over the peaks of this landmark and a violent thunder storm sweeps over Buitenzorg, deluging everything and followed by a marked fall in temperature.

These daily drenchings cause a marvellous growth of all kinds of vegetation and liverworts luxuriate in the steamy hot atmosphere. The garden itself affords many interesting species and the densely shaded gullies and plantations everywhere are crowded with bryophytic growths. Several species of *Riccia*, *R. Treu-*

biana Steph., a large and striking species, being the most noticeable, are common on the paths and upon the ground wherever it is undisturbed, and two species of *Marchantia, M. geminata* Rein., Bl. & Nees and *M. emarginata* Rein., Bl. & Nees, are very abundant. Perhaps the most striking of the ground liverworts of Buitenzorg is *Dumortiera velutina* Schiffn., which is closely related to *D. trichocephala* (Hook.) Nees of the more elevated regions, and seems to take its place in the hotter lowlands. Of the thallose Jungermanniales, the most conspicuous form about Buitenzorg is *Pallavicinia indica* Schiffn., allied to the widespread *P. Lyellii*, but considered by Schiffner to be quite distinct. *Metzgeria Lindbergii* Schiffn. was not uncommon on the trunks of trees in some parts of the gardens and seems widespread through the lower elevations. A large *Riccardia* (*Aneura*), *R. viridissima* Schiffn. was also not uncommon. No collection of the leafy liverworts was made in Buitenzorg, but these are abundant upon the trees everywhere in the deep shade of plantations. Several species of *Anthoceros* are very common, growing upon the ground everywhere, but these have not yet been identified. A *Notothylas*, probably *N. javanicus* Nees, is also not rare, but no specimens of *Dendroceros* were collected about Buitenzorg. The latter, growing as it does in masses of mosses and liverworts, is difficult to find and it is not unlikely that more careful search would have brought it to light.

By far the most interesting collecting ground near Buitenzorg is the region about the foot of the Salak. Here in the dense forest and along the walls of the wild gorge of the Tjiapus there is a wonderful growth of liverworts in great variety. Of the forms quite new to me, the most conspicuous was the very striking *Cyathodium foetidissimum* Schiffn. This grows in little caverns and upon densely shaded rocks, and owing to some peculiarity of the cell-structure the light is reflected from the large chromatophores so that the plant gleams with a vivid emerald light. When handled it emits a very pungent odor like creosote, which clings to the hands tenaciously. The most interesting find was a lot of an *Anthoceros* which proved on examination to have multiple chromatophores, like a fragment which I collected some

ten years ago in Jamaica but had not found since. As this was one of the forms I was especially looking for, its discovery was the event of this interesting expedition. This has since been made the type of a new genus, *Megaceros*. Another undescribed species of the same type was found afterward in the more elevated region about Tjibodas.

Lying on the slope of the magnificent volcanic mass Gedeh, is the mountain station Tjibodas, a dependence of the great garden at Buitenzorg. Tjibodas comprises a garden where are grown many plants of temperate and subtropical regions, and includes a laboratory with living accommodations for four persons. The elevation of the garden is about fourteen hundred meters and I found the temperature almost cooler than I liked after the hothouse temperature of Buitenzorg. The thermometer seldom rises above 20° C. and as it is apt to be foggy and rainy, it is often decidedly chilly, especially in the morning and evening. But in this cool moist atmosphere liverworts revel and I have never seen anything to approach the hepatic flora of this mountain.

From the garden up to the summit of the highest peak, Pangerango, which is ten thousand feet high, is an unbroken primeval forest of wonderful beauty, and overflowing with botanical treasures of every description. For a long distance beyond the garden, which abuts directly upon the forest, a series of paths have been cut through the forest, and these are numbered so that one runs little danger of getting lost in the dense jungle, which without such paths would be quite impenetrable. Many of the finest trees are labeled and several thousand of them are numbered. Otherwise the forest has been untouched.

The paths in the garden and the sides of the banks were often densely overgrown with masses of *Marchantia* and *Anthoceros* of several species. Of the former the most conspicuous was *M. nitida* Lehm. & Lindenb., a large light-green species growing in extensive mats. Several others also occurred.

It was in the forest, however, that the great majority of the forms grew. I naturally was anxious to collect *Treubia* and found that the native collector Sapihin was well acquainted with this; so very soon after my arrival at Tjibodas we started out in

quest of this interesting plant. After a walk of perhaps a couple of miles along one of the main paths skirting the edge of a deep gorge through which flowed a considerable stream, of which only now and then one caught a glimpse through the thick tangle clothing the sides of the gorge, we arrived at our destination. Every few minutes one stopped to gather some rare and beautiful plant. The sides of the path were covered with fine mosses and liverworts, the trunks smothered in mats of liverworts and ferns with all sorts of epiphytic growths among them. Flowers were not very abundant, but yet there were some that would attract the most unobservant eye. A *Gordonia*, a tree loaded with big white blossoms like Cherokee roses, was very common, and often, close to the ground, the bright red cone of a Zingiberaceous plant, an *Elettaria*, caught the eye, or the scarlet bell of an *Aeschynanthus*, an epiphytic Gesneriad, flashed like a spark in the gloom of the dense forest. Exquisite pink and white balsams were very common and now and then a handsome ground orchid was seen. A few small palms grew among the tangle of other plants and splendid tree ferns abounded on all sides. Enormous specimens of *Angiopteris*, one of the Marattiaceae, were common, and upon the trees a great variety of epiphytic ferns, *Ophioglossum pendulum*, *Asplenium Nidus*, various Hymenophyllaceae and many others contended with other plants for a foothold. With all these distractions it was not strange that we were a good while in covering the road to the spot where *Treubia* was to be found. But finally we arrived and plunged into a dense thicket, Sapihin plying the wicked-looking big knife which every Malay seems to carry, to cut through the thick sappy stems of the rank vegetation which choked our path. The *Treubia* was growing in thick mats over fallen rotten logs and on the wet ground, its big fleshy fronds a full inch across, and I soon had a fine lot of specimens in my collecting bag. Near by we also found the rare and beautiful *Calobryum Blumei* Nees, which Goebel rediscovered. This upright liverwort, with its large spirally arranged leaves, looks very much more like a big moss than it does like a liverwort, but the long stalked sporogonium is typically hepatic in aspect. Both of these species were collected repeatedly later on, and although

not common are by no means so rare as has generally been assumed.

Of the more conspicuous liverworts abounding in the immediate vicinity of the Garden, the biggest is *Dumortiera trichocephala* (Hook.) Nees, which reaches gigantic dimensions, but on account of its extreme brittleness is almost impossible to remove entire from the ground, to which it clings tenaciously. A curious fact was brought to light in regard to this species by Prof. A. Ernst, of Zürich, who was staying at Buitenzorg when I was there. He found that the receptacles are very commonly hermaphrodite. This is very easily confirmed on examination. Professor Ernst has since published an account of this fact.

Of the thallose Jungermanniales, aside from *Treubia*, several genera, *Pallavicinia*, *Metzgeria*, and *Riccardia*, are common, and the rare *Calycularia radiculosa* Steph. was also found a number of times. The genus *Riccardia* is especially abundant, including some twenty or more species. Some of these are very large, *R. maxima* Schiffn. having a thallus a centimeter or more in breadth, but other species are exceedingly minute, *e. g.*, *R. parvula* Schiffn. Of the twenty-four species of *Riccardia* given in Schiffner's list, all but four are described as new. Whether these will all hold remains to be seen. I have myself found it impossible to distinguish certainly between his *R. maxima* and *R. viridissima*, and it may be that the number of species may not be quite so great as he assumes. The commonest species of *Pallavicinia* is *P. Levieri* Schiffn., and of the two or three species of *Metzgeria* the widespread *M. hamata* Lindb. is the most abundant. Of the very numerous foliose liverworts one of the most striking was a *Schistochila*, which was not at all rare. The curious little *Zoöpsis argentea* Hook. & Taylor was also collected but was not common.

During the month spent at Tjibodas daily excursions into the forest were made, and one expedition lasting several days was made to the summit of the mountain. This was full of interest and many forms were collected which did not occur at the lower levels. Near the waterfall of Tjiburrum, specimens of *Marchantia cataractarum* Schiffn. were found, a species as yet collected

only from this mountain. The monotypic *Wiesnerella javanica* Schiffn., also known only from this immediate neighborhood, grew in large masses. This is a Marchantiaceous form evidently allied to *Dumortiera*, but having air-chambers and stomata like those of the typical Marchantiaceae. Some remarkable hot springs, Tjipanas, occur on the way up, and the hot steam has caused an extraordinary development of vegetation. Where the hot water oozed out of the hillside thick cushions of *Sphagnum* and other mosses and liverworts grew about the springs. Among the liverworts growing here was *Pallavicinia radiculosa* (Sande Lac.) Schiffn., which was some six inches or more in length. A couple of days were spent at Kandang Badak, a saddle between the two cones of the mountain. At this place, which lies at an altitude of about twenty-five hundred meters, a substantial shelter hut has been built and one can camp out very comfortably here for as long as one wishes. At the higher elevations the hepatic flora is not so well developed as further down, but mosses and lichens are more abundant. Some species of liverworts, however, are confined to this higher elevation. Of these alpine Hepaticae, the beautiful *Pallavicinia Zollingeri* Gottsche is the most striking. This is one of the section, *Mittenia*, with creeping rhizomes and upright fan-shaped dichotomously branched laminae looking like little fern leaves. This beautiful hepatic was common from a height of about twenty-two hundred meters up nearly to the summit of Pangerango, the highest of the two peaks. Pangerango is a very perfect extinct cone, and seems to have a heavier rainfall than the neighboring active crater of Gedeh. Another rare liverwort collected on Pangerango was *Fimbriaria Zollingeri* Steph.

On the return to Tjibodas, a very large and conspicuous *Dendroceros* was collected. The occurrence of this genus at such an elevation (about 2,200 meters) was quite unexpected. This probably is an undescribed species, but no authentic specimens of *D. javanicus*, the only species hitherto recorded from Java, were available for comparison. A second, much smaller species was afterward collected at Tjibodas, but which if either of these is the true *D. javanicus* remains to be seen.

While at Tjibodas further search was made for the *Anthoceros* with multiple chromatophores collected near Buitenzorg. This species was not found, but another one was discovered, much larger and not at all uncommon. This grew usually upon rotten logs but afterwards was found also upon the ground and occasionally upon boulders. It is possible that the form growing upon the boulders is distinct. This species was named *Megaceros Tjibodensis* and a full account of it as well as of the other species has been published (Some Javanese Anthocerotaceae. No. I. Annals of Botany, vol. 21. October, 1907).

A brief excursion was also made to Garoet, lying in the mountains to the southeast of Buitenzorg in a much drier district with a correspondingly poorer flora. The liverworts of this region are some of them xerophytic in character, growing upon more or less exposed rocks. At this place I found *Targionia dioica* Schiffn. and a species of *Fimbriaria* occurring in clefts among the lava blocks upon the exposed slopes of the Goentoer, a volcano in the neighborhood of Garoet. The other forms collected appeared to be the same as those found about Buitenzorg.

No account of the collecting in Java would be complete without an acknowledgment of the very great indebtedness of all botanists to the admirable organization of the botanical gardens and the allied Department of Agriculture, which is largely due to the efforts of the distinguished director, Professor Treub. Everything is done to aid the visiting botanist, all the very complete laboratories and libraries being placed freely at his disposal. The opening of the wonderful forest of Tjibodas and the help of the efficient native collectors, whose acquaintance with the native plants is very extensive, make collecting a comparatively simple and expeditious matter, and one is able in a very short time to accumulate a mass of invaluable material, which it would be impossible to duplicate elsewhere.

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THE CHESTNUT CANKER

By William A. Murrill

Nearly two years have elapsed since I gave the readers of Torreya a brief account of the appearance and life history of this serious fungus disease of our native chestnut and characterized the fungus under the name *Diaporthe parasitica*. Since that time the disease has been reported from many additional localities, and numerous inquiries have been made regarding its nature and treatment.

The origin of the disease and the center of its distribution are still entirely unknown, while the area of its distribution is known very imperfectly as yet and can be determined accurately only by careful field explorations conducted by competent persons. The amount of damage done by it, in and about New York city, where it has been most carefully observed, probably reaches a total of between five and ten million dollars. Of the numerous splendid chestnut trees that once existed in the parks, woodlands, and country estates of this region, it would be difficult to find to-day a hundred perfectly healthy trees; dead trees have been cut by the hundreds during the last two years and the rest will undoubtedly meet the same fate.

Field studies indicate that the chestnut canker is spreading rapidly. The summer spores are so minute and are produced so continuously and abundantly throughout the growing season that rapid distribution by the wind and other agencies is to be expected.

Not only the native chestnut, but also the European and Japanese species, frequently planted in this country, and the chinquapin, growing naturally from New Jersey southward, are known to be subject to its attack. If the disease continues as it has begun, there is, theoretically, no reason apparent why it should not sweep from the country practically every tree, both native and cultivated, of the genus *Castanea*. Let us hope, however, that, in the economy of nature, something will intervene to prevent this.

In the meantime, concerted effort should be made to determine the actual spread of the disease and to prevent its introduction into new localities in this country and in Europe through diseased nursery stock. Affected trees are doomed. There is no treatment except pruning away affected parts, and these are rarely discovered in time to save the tree. Pruning always opens up new points of infection, in addition to the pruning wounds, by causing the death of certain areas that are thus deprived of nutriment. Infection by natural means is also liable to take place at any time.

A careful inspection of several hundred infected trees of all sizes recently cut showed conclusively that pruning with a view to saving the tree is futile. Many of these trees had been carefully pruned with this in mind for two or three years, apparently without the slightest effect. The number of separate infections counted, on young trees as well as old, was remarkable, reaching twenty-five or more in some cases. In many cases, where the disease was more advanced, trunks from two to five feet in diameter were found affected throughout their entire extent from top to base, branches included, the fungus showing in the cracks of the bark on all the older portions and in the lenticels of the younger twigs. A year or two later, the bark sloughs off, leaving the wood white and naked and entirely unaffected by the fungus.

Owners of individual affected trees of large size are advised not to attempt to save them, but to prune away affected branches for the sake of appearance only, until the tree ceases to be an ornament. In the case of a few young trees on the home grounds, careful pruning of affected branches might be tried as a preventive, but I can hold out little hope of success.

It need hardly be said that the planting of any species of chestnut at this time in the affected area would be attended with great risk. Owners of chestnut timber should make use of it at once, thus clearing the woodlands of the sources of infection and giving young trees of other kinds an opportunity to develop.

New York Botanical Garden.

REVIEWS

Druce's List of British Plants*

The appearance of this little octavo of 204 pages, containing the names of 734 genera and 2,958 species, besides a very large number of varieties, may be regarded as an important event in the history of English botany. However inconvenient its pursuit by one's self or by others, nomenclature is a department of botany that is of fundamental importance. As a very general rule, those botanists who are indifferent to it are not numbered among either the more careful or the better informed, a fact which, in the nature of the case, could not be otherwise. The study of botany, native and foreign, in England, has suffered through the neglect of this subject, a neglect which has been to a great extent forced upon many who disapprove of it, by the exigencies of official requirement. Oxford is one of the places where such repressive influence is least felt, and it is but natural that the rational revision of British plant names should have been there undertaken. The attitude of Mr. Druce toward this subject was made very clear when he successfully contended for the starting point in priority that has since been almost universally accepted. Pharmaceutical botany felt his influence when he recognized the doctrine of priority, and rejoiced that the principles of Bentley and Trimen were to be by him maintained. His opinions are illustrated by the following extract from the preface to the "List":

"The oldest generic and specific name is chosen where possible, the starting-point being the first edition of the *Species Plantarum* of 1753, a date and work first suggested by the compiler in a paper on nomenclature (*Pharmaceutical Journal*, p. 789, 1892). At that time, the date of the first edition of the *Genera Plantarum*, 1737, was adopted by the committee which framed the Paris 'Leges' as the starting-point of generic citation, and it was only after some considerable correspondence that the writer

*List of British plants, containing the Spermophytes, Pteridophytes and Charads found either as natives or growing in a wild state in Britain, Ireland, or the Channel Isles. By George Claridge Druce, M.A., F.L.S., Secretary of the Botanical Exchange Club and Fielding Curator in the University of Oxford. Clarendon Press, 1908.

induced M. Alphonse de Candolle to support his view that generic and specific citation should both date from 1753. Independently, Professor Ascherson and other Berlin botanists pressed for the same object, and that date is now generally accepted, and was adopted in one of the 'Actes' passed at the Vienna Congress of 1905.

"But at that Congress, unfortunately, several genera were made into a favoured list of 'Nomina Conservanda,' despite the fact that others, avowedly of a prior date, existed. Space does not allow the matter to be laboured here, but it must be said that this list is either unnecessary or insufficient; for instance, the well-defined and definite genus *Mariana* Hill is put among the names which are to be rejected, while *Radicula* Hill (a faulty name, and a badly defined genus, excluding as it does the Water-Cress, which may be looked on as the type of the genus, and including the yellow-flowered species only) may be used. This and other inconsistencies must in the long-run outrage the sense of justice, which after all is a key-note of botanical as well as human laws. Therefore the 'Nomina Conservanda' of the Vienna Congress are here deliberately ignored when other generic names which appear to be properly diagnosed have priority. An important section of Transatlantic botanists take the same course, and in the *Bulletin of the Torrey Botanical Club*, April, 1907* (which appeared after this *List* was prepared), state that 'they regard [the exclusion of several hundred generic names of plants from the operation of all nomenclatorial rules] as in the highest degree arbitrary, as controverting a cardinal principle.' This is not only common sense, but practical and just. A plan which accepts *Phyllitis* Hill and conserves *Silybum* Gaertn., 1791, in preference to *Mariana* Hill, 1762, or which retains an inchoate pseudo-homonymous genus like *Epipactis* of Adanson or Crantz, or the faulty *Gloriosa* L., but rejects *Capnoides* Adans., which was founded by Tournefort, and the identity of which is undoubted, fails to inspire confidence, and certainly does not commend itself on the ground either of justice or consistency. In many cases there must be diversity of opinion, and exception may quite fairly be taken to some of the names here employed, but an endeavour has been made to carry out consistently the principles of priority."

By ignoring the foolish and crude list, forced by the Berlin

* The canons framed by the botanists at the meeting in Philadelphia in March, 1904, which are reprinted in the *Bulletin*, l. c., have much to commend them for their practical common sense.

botanists upon the Vienna Congress, and standing out for priority, Mr. Druce's results come very close to those reached by adhering to the theory of types, to which theory we again invite attention, believing that a position must be reached in which genera will stand or fall with their type species. If no type was assigned by the author of the genus, one must be assigned by some combination of considerations. For North American genera, types are rapidly being established by one author or another, and it is to be hoped that European genera will also become fixed by this method. Descriptions of genera without any species assigned them will not stand against genera with designated types.

A system which retains *Posoqueria* Aublet, 1775, but rejects *Icacorea* Aublet, 1775, both published as monotypic in the same work, and which retains *Piscidia* L., 1759, while rejecting *Ichthyomethia* P. Browne, 1756, both based on the same type, is bound by its very absurdity to fail. We think that the Berlin botanists, by proposing this highly arbitrary means of attempting to steady the use of generic names, failed to take advantage of a great opportunity, which they were not ingenious enough to see.

The manner in which Mr. Druce has performed the present piece of work is highly creditable. By a carefully elaborated system of symbols and typography, his list tells us whether a given plant is native or doubtfully so, whether of fugitive or occasional occurrence, or established, if it has become extinct, if found only in the country cited, and other facts regarding distribution, if a probable hybrid, and if so, which is its dominant parent. The author states that during thirty years' collecting, he has seen all but fifty of the plants listed growing *in situ*. Synonyms are given only when this is necessary for some special reason. Specific names are capitalized when of previous generic significance, when personal or when terminating in *oides*, "this being evidently the intention of Linnaeus." The ending *aceae* is retained for family names. Since the list is to be used largely as a check-list, for exchange purposes, all specific names are consecutively numbered. The parenthetical citation of authors is employed in cases of generic and varietal, but not for specific names.

The author's strong — we think too strong — tendency to unite genera is indicated in his inclusion of both *Pulsatilla* and *Hepatica* in *Anemone*, and *Batrachium* in *Ranunculus*.

Mr. Druce's list, by excluding, in deference to the Vienna Rules, duplicate binomials, fails to record important nomenclatorial facts, just as it does in omitting parenthetical citations of authors of specific names. In the latter case, indeed, the omission actually involves misstatement. That such loss, if noted, is accepted by the author out of sheer dislike for unfamiliar mechanical form would seem to be indicated by his treatment of other names which, for every reason except such form, have less to commend them than the double names referred to.

He admits the name *Cerastium cerastioides* Britton, an inane binomial, made necessary by the priority of the specific name of the plant described by Linnaeus as *Stellaria cerastioides*. We do not understand why, as he accepts this meaningless name, he should decline to accept names like *Mariana Mariana* Hill, or *Coronopus Coronopus* Karsten, which are not meaningless, but very significant, indicating as they do, that *Carduus Mariana* L. is the type species of *Mariana* and that *Lepidium Coronopus* L. is the type species of *Coronopus*. These duplicate names were rejected at Vienna by a close vote, taken after Professor Engler had made the naïve complaint that some of his students laughed at them! There is plenty of good precedent for their retention, both botanical and zoölogical.

The list prepared by Mr. Druce will be of great value, not alone to the members of the British local clubs and societies to whose membership it is primarily addressed, but to students in America and in Continental Europe. In Great Britain it cannot fail to mold opinion and to fix the usage of many plant names for a long period. Emanating as it does from Oxford University, it is assured a distinguished and independent audience; we congratulate Mr. Druce on its appearance!

H. H. Rusby,
N. L. Britton.

PROCEEDINGS OF THE CLUB

March 25, 1908

The meeting was held at the museum of the New York Botanical Garden, with Dr. John Hendley Barnhart in the chair. The minutes of the meetings of February 26 and March 10 were read and approved. A special committee of the Club appointed on February 11 reported as follows:

At a regular meeting of the Torrey Botanical Club held at the American Museum of Natural History, February 11, 1908, a committee was appointed to draft resolutions concerning the death of the late Morris K. Jesup.

Be it therefore resolved, that the Secretary be instructed to enter in the proceedings of the Torrey Botanical Club, and transmit to the Board of Trustees of the American Museum of Natural History, this record of our sincere regret at the loss of one who always manifested such a broad and deep interest in all matters pertaining to natural science.

The report of this special committee was unanimously accepted and adopted. The scientific program was then taken up and two papers were read, of which the following abstracts have been furnished by the authors:

"Botanical Experiences in western South Carolina," by Mr. Homer D. House.

The richness of the flora of the southern Alleghany mountains was commented upon, special attention being directed to the beauty of the mountains in early June, when several species of *Azalea* and *Rhododendron* are in bloom. Two trips into the mountains were described, one to Jocassee Valley for *Sherwoodia* (commonly known as *Shortia*) and to Tomassee Knob and Tomassee Falls. At the latter place several northern plants were collected, among others *Viola canadensis*, *Trillium grandiflorum*, *Filix bulbifera*, and *Dryopteris Goldiana*. The second trip was to Rabun Bald in Georgia during early June. The top of this mountain is covered with *Rhododendron catawbiense*, which was at that time in full bloom. In the thickets around the coves on the eastern slope of the mountain a new species of

bindweed, *Convolvulus sericatus*, was found. *Viola rotundifolia* also was found here, as well as in adjacent South Carolina, thus considerably extending its known range. The speaker exhibited a large number of specimens, several of them new to South Carolina, and commented upon their distribution.

"Observations on the Nutrition of *Sarracenia*," by Winifred J. Robinson.

Plants of *Sarracenia purpurea*, the common northern pitcher-plant, were exhibited and several colored illustrations of the plant in flower were shown.

The present series of experiments was undertaken under the direction of Professor William J. Gies, at the New York Botanical Garden in the summer and autumn of 1907, to determine the digestive power of *Sarracenia purpurea*, on carbohydrates, fats, and proteins. Solutions of great difference in concentration were introduced into the pitchers and it was found that they resisted distilled water and 33⅓ per cent. sugar solution equally well. Acid and alkaline solutions of a very low concentration had no apparent effect upon the pitchers, but a 0.5 per cent. solution of acetic acid and a 1 per cent. solution of potassium nitrate both proved injurious. Sachs's nutrient solution caused the pitchers to decay within a few days. Liebig's meat-extract was used as a test of the effect of a stimulant. Bacteria and infusoria developed in great numbers and decay began in a few days. Solutions of milk in distilled water of different proportions were used, from the results of which it was inferred that the pitcher produced an alkaline substance which reacted with the acid produced in a very dilute solution of milk, but was not sufficient to neutralize solutions of greater strength. There was nothing to indicate that the milk fat or protein was digested. Solutions of grape-sugar and cane-sugar of different proportions were placed in the pitchers and there were no indications of a detrimental effect upon them. With Fehling's solution, the contents of the pitcher, after the sugar solution had been allowed to remain in them several days, gave a reddish precipitate of copper oxide, indicating the presence of invert sugar. The reduction was most marked in a 10 per cent. solution of cane-sugar.

Starch paste was allowed to remain in the pitchers from three to seven days, when it was removed and tested by boiling with Fehling's solution. The reddish precipitate indicated that a reduction had taken place, though it was not so marked as in the case of the cane-sugar. The addition of an antiseptic did not hinder the reduction of the cane-sugar or starch. Olive-oil and ethyl butyrate were used to test the fat-digesting power of *Sarracenia*, but the results indicated no digestion. Fibrin was used to determine the digestive power upon protein, but the results were negative. These results as to protein correspond with those obtained by Schimper in 1882 (Bot. Zeit. **40**: 225) and by Goebel in 1893 (Pflanz. Biol. Schild. **2** : 186).

MARSHALL A. HOWE,
Secretary pro tem.

APRIL 14, 1908

The Club was called to order at 8:30 o'clock by Vice-President, John Hendley Barnhart. Seven persons were present.

After the reading and approval of the minutes of the preceding meeting, the name of Mrs. M. H. Reed, 185 Audubon Avenue, New York City, was presented for membership.

The report of the Committee, appointed at the meeting of January 14, 1908, to audit the books and accounts of the Treasurer of the Club for the year 1907, was read and approved.

Resignations were read and accepted from Mr. C. M. Bergstresser and Mr. O. M. Oleson. The Secretary was directed to cast the ballot of the Club electing Mrs. M. H. Reed to membership.

The scientific program consisted of two papers as follows :

"The Relation of Chemical Stimulation to Nitrogen Fixation *Sterigmatocystis*," by Marion E. Latham.

This paper will appear in full in a future number of the "Bulletin" of the Club.

"Some Forms of Protoplasmic reaction," by H. M. Richards.

The speaker reviewed the more recent literature and theories bearing on the subject of the stimulus and response of protoplasm.

Both of these papers were followed by an interesting discussion, and the meeting adjourned at 10 o'clock.

C. Stuart Gager,
Secretary.

OF INTEREST TO TEACHERS

Notes on Experiments in Plant Respiration

Jane R. Condit

The experiment designed to show that plants give off carbon dioxide rarely gives satisfactory results with the simple apparatus that can be handled by high school pupils. The withdrawal of the air under water is too complicated for pupils of this age. Contrasting results are not always secured by placing small dishes of lime-water under bell jars with and without growing plants because of the proportionately large amount of air from the room enclosed in each.

In the following experiments in plant respiration a simple method of obtaining samples of air for the carbon dioxide test is given; and contrasting results are certain because of the small but equal amount of air in the check bottle.

A small jar was one-fourth filled with damp germinating barley and placed in the dark. When a lighted match was placed in the jar two days later the flame was extinguished at once, showing that the barley had used so much of the oxygen in the jar that there was not enough left to support combustion. A match placed in a similar check jar without the barley continued to burn for some time.

A small wide-mouthed bottle was filled with the gas from the barley jar by first filling it with water and then inverting it in the jar. When fresh lime-water was added to the gaseous contents of the bottle, a heavy white precipitate appeared. A similar check bottle full of ordinary air did not show this precipitate when the lime-water was added. This showed that carbon dioxide must have been given off by the germinating seeds.

The jar was again sealed, placed in the sun light and left for a week. When the leaves had become green the gas in the jar

was then tested with a lighted match. This time the light was not extinguished, showing that the green leaves had given off oxygen.

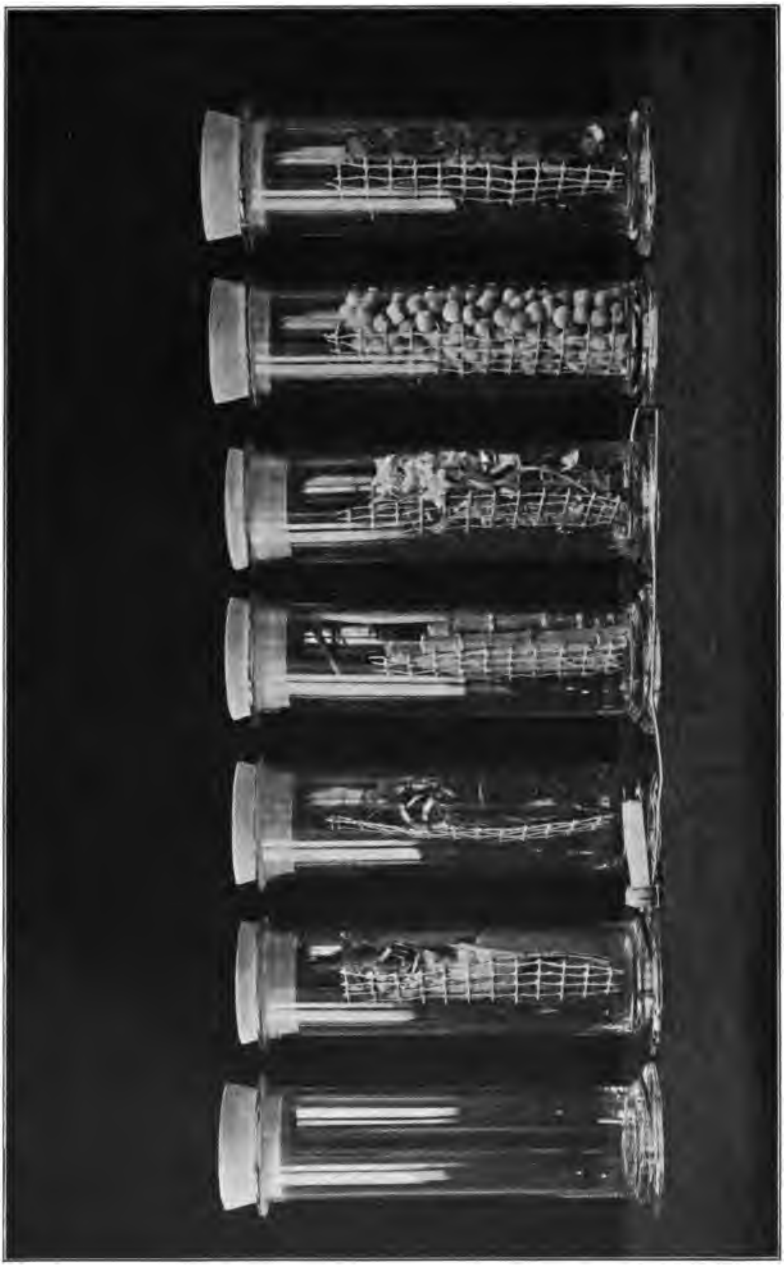
TEACHERS COLLEGE.

A SIMPLE MODIFICATION OF THE EXPERIMENT TO SHOW THE GASEOUS EXCHANGE IN PLANT RESPIRATION

BY C. STUART GAGER

In the experiment to teach the gaseous exchange accompanying the respiration of various plant organs it is essential to show two facts: first, that the oxygen has been absorbed, and, second, that carbon dioxide has been given off. The very common practice of partially filling glass jars with the tissues to be investigated is unsatisfactory in several ways. It is not always easy to lower the lighted taper as far down into the jar as is desirable, and, furthermore, when the lime-water test is applied it is either necessary to remove a sample of the air from the jar, or else pour the lime-water into the jar. The first operation is not easy, and only invites failure. By the second method the lime-water is liable to become so dirty from contact with the plant material, or so obscured by it, that its change to a milky color must be taken largely on faith.

The simple device, shown in the acompanying illustration, does away almost entirely with the above annoyances. A partition of wire netting divides the jar vertically, and leaves a space to one side into which the burning taper may be inserted as far down the jar as necessary. The wire netting should be of somewhat smaller mesh than that shown in the photograph, and should fit snugly into the jar so that the latter may be tipped over slightly. The lime-water may then be poured in at the side opposite the plant-material, and (after the stopper is tightly replaced) shaken well up and down the jar to insure thorough contact with the carbon dioxide. By this means the lime-water is not clouded with dirt from the plants. After the netting has been once prepared it requires practically no more time to set up the experiment than without the netting, while the operations that must be



Apparatus for demonstrating the gaseous exchange in plant-respiration.

performed in the presence of the class are not only smaller in number, but much simpler than when a sample of the air must be removed to be tested.

In the illustration the six jars, besides the empty one, contain, respectively, green leaves, roots, stems, variously colored flowers, germinating seeds, and some kind of fleshy fungus.

NEW YORK BOTANICAL GARDEN.

NEWS ITEMS

Professor H. A. Winkenwerden of the U. S. Bureau of Forestry, is to succeed Professor J. F. Baker as professor of forestry at the Colorado School of Forestry.

Mr. R. H. Biffen, whose researches on the hybridization of wheat and barley have attracted much attention, has been elected to the recently established chair of agricultural botany at Cambridge University.

The Graduate School of Agriculture will hold its third session at Ithaca and Geneva, beginning July 6, 1908, and continuing for a month. The botanical subjects included are Agronomy and Horticulture.

The Marine Biological Laboratory will hold its twenty-first session at Woods Hole, from June 1 to October 1, 1908. The work will include embryology and botany, the latter being under the direction of Dr. George T. Moore.

There is to be held from September 14 to 26 of this year in Olympia Hall, London, England, an International Rubber and Allied Trades Exhibition. Professor Francis E. Lloyd, a member of the Torrey Club, is one of the Mexican Committee, of which Dr. Pehr Olsson-Seffer is Chairman.

The nineteenth annual session of the Biological Laboratory of the Brooklyn Institute of Arts and Sciences will be held at Cold Spring Harbor for six weeks, beginning Wednesday, July 1. The laboratory is also open for investigators during the entire summer. The courses offered include cryptogamic botany, plant ecology, and beginning research in botany.

The Naples Table Association for Promoting Laboratory Research by Women announces the offer of a fourth prize of one thousand dollars for the best thesis written by a woman, on a scientific subject, embodying new observations and new conclusions based on an independent laboratory research in biological, chemical or physical science. The theses must be presented before February 25, 1909. For further information address Mrs. E. H. Richards, Massachusetts Institute of Technology, Boston.

New Zealand with over a million acres of native forest land estimated to last seventy years, has reorganized the forestry movement dropped some years ago because of its cost. It is an attempt to remedy what is now conceded to be a serious mistake and nurseries and plantations are being extended rapidly. Trees from the United States, Europe, and Australia are being systematically introduced, as the native trees of New Zealand are very slow in growth. Some of the largest trees which produce excellent timber need two hundred or more years to complete their growth.

Attention is called to the botanical excursion planned by the University of Washington for the summer of 1909, under the direction of Dr. T. C. Frye, of the department of botany. The general plan is to leave Seattle about July 1, and go as far north as Skagway. From the chief cities as a base excursions will be made into the mountains, to glaciers, to mines and along the seashore. The work, which will include lectures on plant ecology and opportunities for collecting material, will close in Alaska six weeks from date of sailing from Seattle. The expense will be $20 incidental fee, about $70 steamer fare, and the living expenses which are estimated at $80 for the six weeks, making a total of about $175 from Seattle.

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BOTANY.*

By Herbert Maule Richards.

So much then for the purely theoretical side of botanical research of which I have presented a hasty glimpse. It is necessary before closing to make some reference to the utilitarian aspect; where and how botany directly serves the material needs of man. I hold it myself to be a matter of some pride that a science like botany with a side so purely theoretical and impractical can also lend itself to further, in such important ways as it does, the well-being of mankind, for in the direct application of botanical information to agricultural questions the ways and means of life may be ameliorated. Moreover, it is some of the most theoretical and recondite researches which have led to the most important practical results.

It is possible to consider only a few phases of the practical application of botany, and I will choose those which are not commonly recognized, and which require a high degree of special botanical training. The necessity of botanical knowledge in the use of plants and their products in the arts, or as drugs, is easily understood without further reference, and such uses do not necessarily involve any broad knowledge of plants as a whole.

It is quite different, however, in the matter of plant pathology, for here every channel of botanical information must be used to investigate plant ailments. Bacteria and parasitic fungi, which are themselves plants of a low order, are the cause of the bulk of plant diseases and for that reason the study of their life his-

* A lecture delivered at Columbia University in the Series of Science, Philosophy, and Art, December 4, 1907, copyrighted and published by the Columbia University Press, February, 1908, and reprinted by permission in Torreya, beginning with the March number.

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tories becomes a matter of no small importance. Then, too, the structure and habits of the host plants must be taken into consideration, for upon these may depend the means of prevention or of cure. The assembling of this information and its practical application to the question in hand devolve upon that type of botanist usually referred to as the mycologist, and despite many failures much that is of substantial practical use has been established. One of the earliest, if not the earliest, recorded instances of where a community has taken formal notice of the fungus pests of plants is found in the old Barberry Law passed by the province of Massachusetts before the Revolution. This called for the extirpation of the barberry which had been noticed by the colonists, without any knowledge on their part of the real cause, to be connected with the rust of their wheat fields. To-day we may not pass laws for the destruction of diseased plants, realizing perhaps the hopelessness of enforcing them, but we combat plant disease by the establishment of experiment stations devoted to the investigation of such matters.

As a result, there is now at the disposal of the agriculturalist much definite information of ways and means of diminishing or preventing loss through the destruction of crops by disease, losses which statistics show may amount to tens of millions annually; and while the study of the action of bacteria and fungi in the disease of plants is by no means complete, no one can deny the practical results which have been attained. In the more indefinite functional diseases of plants not ascribable to definite parasites, there is room for much more information, which will be forthcoming when our knowledge of nutrition physiology is more full. Already, however, we have suggestions as to the cause of the functional diseases which often appear where the same crop has been raised for many years in succession in the same spot, which bid fair to explain some important plant ailments that are at present not understood.

A more popularly interesting line of activity that has a practical bearing is found in plant breeding, which has recently been attracting wide attention. Plants are now bred systematically for desired characters, not always for increased yield only, but

also for such qualities as resistance to extremes of temperature, to lack of moisture in dry or semi-arid regions, to resistance towards specific diseases, and even for the more esthetic qualities of flavor or color. The old hit or miss methods of the improvement of strains by empirical rules of selection is passing away, and more and more scientific methods, based on the latest results of investigations of heredity and variation, are being employed. Passing over the older methods I will take up two very different types of plant breeding, both modern: one the strictly scientific, the other the intuitive.

The first method we owe largely to Nilsson, who introduced it at an experiment station in Sweden in connection with the cultivation of various cereal crops. It may be said that previous to his advent the older methods had been tried and abandoned as a failure. With his knowledge of what had been published about heredity and variation, Nilsson, after some preliminary experiments, arrived at the conclusion that no new, pure, or constant strains of wheat could be obtained unless the fruit of a single ear was bred separately, and thus he established what is known as the principle of breeding from the single ear and not from assorted lots of seed taken from many individuals. This breeding he continued, picking out any chance favorable ear which he could find, until he obtained many thousands of different forms owing to this multiplicity of strains mixed in the ordinary wheat. Of course some turned out to be mere bastard strains and only the ones which continued to breed true to character were kept. These constituted the new agricultural varieties—in reality elementary species and mutants—which, after severe tests had proved them suitable, were raised in marketable quantity for seed. The amount of work involved was enormous, the mere bookkeeping of the accurate pedigree record with notes on the life history of each form and its progeny was in itself no small matter. Besides the principle of single-ear breeding, Nilsson also established the fact that but a single selection alone is necessary to fix a new strain, provided the progeny of the chosen ear are carefully guarded from admixture with other forms. All this seems absurdly simple, and it is simple, so much so that it is quite possible of application by a

person of average intelligence who has had the proper instruction; but the important point is that it was discovered by the application of thoroughly scientific methods. Nilsson's principle is in very general application to-day and is being used to excellent effect in the improvement of Indian corn in the middle West.

Contrast with this the methods of Mr. Burbank, whose name is familiar to all. It is not that he should not be given the credit of having established new and useful strains of cultivated plants, or of having done some remarkable feats in the way of plant breeding; but it is that his methods are almost purely intuitive and would die with him, were his own records all that there was to be left behind, a striking difference from the mass of data accumulated by Nilsson. It is the rule of thumb method, picturesque but uncertain, as against the surer but less romantic practices of science.

The matter of general scientific agriculture opens an immense field in which I can call your attention to a few points only. The scientific care of our forests, for trees may be regarded as a crop and their culture agriculture, is a question to which we in this country are awakening none too soon. Forestry as practised in Europe, demanding as it does expert botanical knowledge, perhaps not by the foresters themselves but by those who direct their labors, has saved what were the fast diminishing wooded areas. There is need of haste with us for similar scientific treatment of the problem by men who are not simply woodsmen, but botanists as well.

The scientific rotation of crops, the use of fertilizers, and the study of the physical and chemical condition of the soil in connection with the living plants, involve questions which may mean the success or failure of much of our farming. These questions can only be settled by careful investigations which take into consideration the nature of the plants themselves as well as the physical conditions of their environment. Some may say that knowledge along this line has been satisfactorily handed down from father to son, that the farmer knows his business better than does the scientist, but it is a patent fact that this is not so. For instance, many a farm which has been damaged for a long period of years by the over-liming of the soil might have been spared had

the farmer of fifty years ago had the knowledge, which we now have, of the relation of lime to the other mineral substances needed by the plant, of when to apply it, and when to withhold it. It is the difference between merely empirical knowledge and that which is based on scientific principles.

When the contest comes between virgin soil and long tilled land, the latter, no matter how rich it may once have been, must needs be cultivated more intensively if it is to hold its own. Intensive cultivation requires the aid of special information and it is here that scientific agriculture comes into play. Few people realize that without artificial fertilizers, the direct outcome of highly theoretical work on the raw food stuffs of plants, much of the farming of to-day would be almost impossible. And the proper use of fertilizers is but one of many questions.

We are coming now in this country to a stage in its development when scientific agriculture must be seriously considered. Fortunately it is being so considered and the federal and state establishments devoted to the investigation of these agricultural questions may confidently be expected, I think, to help in the solving of the practical economic questions that must arise in the competition of our own agriculture with that of other lands. The way it must be done is by the introduction of improved methods based on carefully conducted scientific research, that often find their stimulus in the highly theoretical investigations of the pure scientist. Thus must the so-called impractical devotee of science come in contact with the practical man of affairs and furnish him knowledge that can be used for the benefit of all.

In this somewhat categorical fashion then, I have endeavored to present to you some of the content of the science of botany; that science which consists of the dismembering of flowers and the giving to them of long names. What its future will be is perhaps already indicated, but briefly you can see that it is in the direction of physiological advance, away from pure taxonomy and formal morphological conceptions towards the realm of function; away, too, from any segregation of the science from kindred fields towards a better understanding of the place of plants in the whole cosmic scheme.

Man's attitude towards the unknown — his philosophy in short — must influence his attitude towards botany as it will towards any science ; and since philosophy, like other lines of intellectual activity, changes and progresses, man's attitude towards science is not a fixed or rigid one. But it is not likely that philosophy will ever tend to discourage investigation, and investigation is the keynote of scientific progress. Unquestionably, the world demands research, and any fact no matter how humble, if accurately established, helps on the cause. Perhaps the time will come when our knowledge of to-day will seem as crude as that of yesterday now seems to us. Let not that concern us, except to urge us to do what we may in hastening this time, knowing that that is where real progress lies, and knowing too that there is ample work that can and must be done.

A KEY TO THE WHITE AND BRIGHT-COLORED SESSILE POLYPOREAE OF TEMPERATE NORTH AMERICA—III*

By William A. Murrill

K. The Species of Coriolus

1. Tubes more or less entire, at least until the sporophore is quite old. 2
   Tubes soon breaking up into long irpiciform teeth. 19
2. Surface of pileus wholly or partly glabrous when mature or clothed only with inconspicuous hairs. 3
   Surface of pileus clothed entirely with a conspicuous, hairy covering. 17
3. Pileus not entirely glabrous at maturity. 4
   Pileus entirely glabrous at maturity. 13
4. Pileus marked at maturity with glabrous zones of a different color from the rest of the surface. 5
   Pileus not marked with glabrous zones, but nearly uniform in color and rarely shining. 10
5. Glabrous zones large, numerous, conspicuously and variously colored. *C. versicolor* (L.) Quél.
   Glabrous zones small and comparatively inconspicuous. 6
6. Surface villose between the zones, which are late in appearing ; plants small, 1–2 cm. in diameter. *C. hirsutulus* (Schw.) Murrill

* This concludes the series of keys to the pileate species of polypores found in temperate North America. The resupinate species are more difficult, most of them requiring the facilities of a well-equipped herbarium, as well as considerable experience, for their proper determination.

Surface minutely pubescent or tomentose between the zones; plants usually much larger. 7

7. Hymenium white or yellowish. 8

Hymenium umbrinous or fuscous. 9

8. Tubes small, 5 to a mm., perfectly regular and entire. *C. ectypus* (B. & C.) Pat.

Tubes twice as large, often irregular from splitting; glabrous zones late in appearing and sometimes absent. *C. pubescens* (Schum.) Murrill

9. Hymenium umbrinous; surface opaque, with very few zones. *C. alabamensis* Murrill

Hymenium fuscous; surface shining, multizonate. *C. sector* (Ehrenb.) Pat.

10. Sporophore semiresupinate, narrowly reflexed. 11

Sporophore normally pileate, sometimes decurrent. 12

11. Tubes 1 cm. or more in length. *C. subluteus* (E. & E.) Murrill

Tubes only a few millimeters long, hexagonal, 1 mm. broad. *C. hexagoniformis* Murrill

12. Margin broadly sterile, the sterile zone about 2 mm. broad. *C. limitatus* (B. & C.) Murrill

Margin fertile or narrowly sterile. *C. balsameus* (Peck) Murrill

13. Surface brown or blackish. *C. planellus* Murrill

Surface white to isabelline. 14

14. Margin of pileus very thin, becoming fimbriate or lacerate at maturity. *C. Drummondii* (Kl.) Pat.

Margin of pileus not as above. 15

15. Surface rough, scabrous; pileus rather small, usually cuneate. *C. Lloydii* Murrill

Surface perfectly smooth between the zones; pileus fan-shaped. 16

16. Surface white to ochraceous, the zones deeper yellow. *C. ochrotinctellus* Murrill

Surface isabelline with pale-latericeous zones. *C. concentricus* Murrill

17. Pileus 5 mm. or more thick, tubes small and regular. 18

Pileus much thinner, tubes large and irregular. *C. sericeohirsutus* (Kl.) Murrill

18. Surface roughly hirsute. *C. nigromarginatus* (Schw.) Murrill

Surface finely hirtose-tomentose. *C. subchartaceus* Murrill

19. Pileus large, 5–10 cm. broad, 5–10 mm. thick, fibrillose-tomentose to subglabrous; confined to deciduous wood. *C. biformis* (Kl.) Murrill

Pileus smaller and much thinner. 20

20. Surface ashy-white, villose, confined to coniferous wood. *C. abietinus* (Dicks.) Quél.

Surface wood-colored, finely tomentose; usually found on deciduous wood. *C. prolificans* (Fr.) Murrill

L. The Species of Coriolellus

1. Pileus white or pale-isabelline. 2

Pileus cinereous-fuscous, glabrous. *C. Sequoiae* (Copeland) Murrill

Pileus fulvous to latericeous, finely tomentose to minutely strigose. *C. serialis* (Fr.) Murrill

2. Surface conspicuously villose to strigose; context very soft and spongy. *C. cuneatus* Murrill

Surface finely tomentose to glabrous; context firm. *C. Sepium* (Berk.) Murrill

M. The Species of Aurantiporellus

Pileus soft, effused, orange-colored, 1–4 cm. thick. *A. alboluteus* (E. & E.) Murrill

N. The Species of Pycnoporellus

Pileus thin, dimidiate, orange-colored, friable when dry. *P. fibrillosus* (Karst.) Murrill

O. The Species of Pycnoporus

1. Pileus thick, smooth, opaque. *P. cinnabarinus* (Jacq.) Karst.
Pileus thin, often zonate, brilliant-red. *P. sanguineus* (L.) Murrill

P. The Species of Aurantiporus

Pileus ochraceous or reddish-orange, tubes orange when fresh, becoming dark and resinous on drying. *A. Pilotae* (Schw.) Murrill

Q. The Species of Laetiporus

Pileus large, yellow throughout, fragile when dry. *L. speciosus* (Batt.) Murrill

New York Botanical Garden.

TERATOLOGICAL NOTES

By C. Stuart Gager

The following instances of structural abnormalities are not presented as contributions. Most of them have been reported before, and some of them often, either in the species here recorded, or in allied species. In complying with a request from the editor of Torreya for an article on teratological observations, it was thought that those given below would be of popular interest, and it is hoped that the paper may stimulate further observations, especially on the part of amateur botanists.

Polycotyly and Syncotyly in Onagra biennis. — Seedlings of dicotyledonous species having three cotyledons are of frequent occurrence, and in "Die Mutationstheorie," de Vries describes such seedlings for *Oenothera Lamarckiana*, *O. laevifolia*, *O. lata*, and *O. rubrinervis*. In experimental pedigreed cultures he found the anomaly hereditary in less than three per cent. of the offspring of plants that possessed it. Fusion of the two cotyledons into one was figured by de Vries for *O. glauca*, and, in crossing half and middle races ("Die Mutationtheorie" 2 : 345), this was

found to be a Mendelian character. I have found an instance of both tricotyly and syncotyly this spring in pedigreed cultures of *O. biennis.*

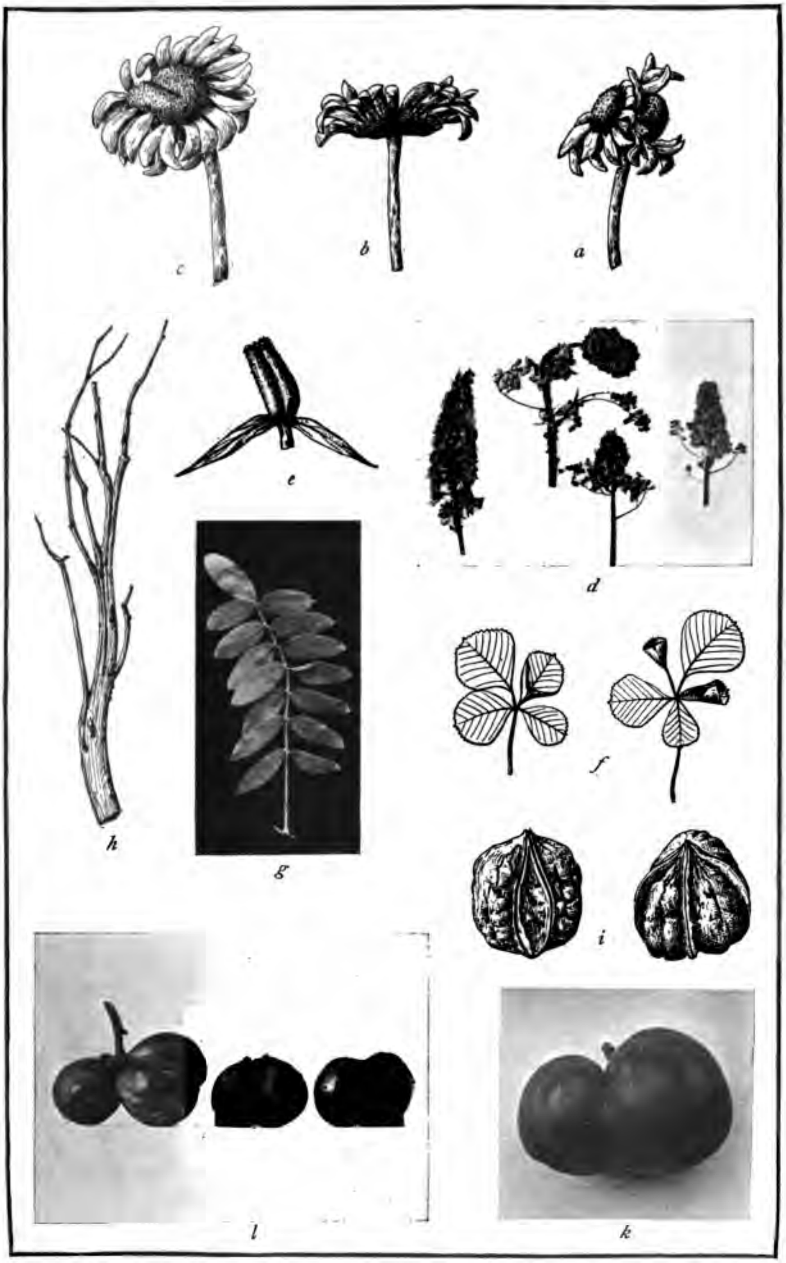
Fusion of Capsules in Onagra biennis. — In "Die Mutationstheorie" de Vries (*l. c.* **2** : 349–350) has called attention to cases of the occurrence of two flowers in the axil of one leaf in *Oenothera Lamarckiana.* Both flowers produced capsules with seeds and de Vries suggests that the anomaly is due to the development of a supernumerary flower in the axil of an undeveloped supernumerary leaf. Among pedigreed cultures of *O. biennis,* I observed one instance, in the fall of 1907, of two capsules, one very slightly above the other, fused or grafted together throughout their entire length. Each capsule was in the axil of a separate bract, as pictured in figure *e,* and both contained maturing seeds.

A Twin Apple. — Twin fruits of the apple, pear, strawberry, plum, cucumber, and many other species are, as is well known, not at all uncommon. Much literature on this point is cited by Moquin-Tandon, Masters, and Penzig. In the Gardener's Chronicle for 1855 (p. 692), there is figured a twin apple caused by two flowers being "accidently brought into close contact in the earliest state of the bud, being kept firmly in contact as they advanced in growth," and ending "by becoming half incorporated." In the same magazine, in 1879 (**46** : 767), the same sport is again noted, and is said to be not uncommon in the Cluster Golden Pippin, and frequent in the Bedfordshire Twin. Also in the same publication (**54** : 564. 1883) is recorded a case of triplet apples, three "fused together into one mass at the base." Sometimes there are two peduncles, one for each half of the twin, and an instance has been recorded in which one of the peduncles has become broken off from the branch, so that the nourishment of the fruit attached to it had to be derived entirely from the apple with which it was fused. Masters (Vegetable Teratology, p. 20) figures an example of the adhesion of two apples, and, on page 327, a case of interrupted growth, where the peduncle above the normally formed fruit has filled out, and formed a much smaller fruit above the first. In the specimen illustrated in the accompanying figure, and probably a variety of the russet, the peduncle

bears a fringed ridge lengthwise along one side, indicating that it was formed by the fusion of two adjacent peduncles. The specimen shown in figure *k* was presented to the writer by Professor Underwood in the autumn of 1907.

Twin and Triplet Hickory Nuts. — Monstrosities in the hickory are relatively rare. An embryo of *Hicoria ovata* (*Carya alba* Nutt.) with three cotyledons has been described by Dr. N. L. Britton (Bull. Torrey Club **7**: 21. Feb. 1880) and by H. C. B[eardsley] (*ibid.* **7**: 54. May 1880). Dr. Britton has also described a tree of *Hicoria glabra* (*Carya porcina* Nutt.) where most of the leaves, normally pinnately compound, were simple (*ibid.* **8**: 132. 1881). Dr. Arthur Hollick exhibited before the Torrey Club in 1881 (*ibid.* **8**: 60) a distorted fruit of *Hicoria glabra* (*Carya porcina*) which he described as occurring year after year near Court House Station, on the Staten Island Railroad. Only two or three other monstrosities are noted in this genus by Penzig. In 1886 Dr. Hollick (Proc. Nat. Sci. Assoc., Staten Island **1**: 35) exhibited and described twins and triplets of *Hicoria alba* (*Carya tomentosa*). "The twins," he says, "were generally perfectly joined, but the triplets were separate, with the sides flattened where they pressed against each other, similar to chestnuts in a bur. All the nuts from the same tree were more or less affected." Such a variation as this is well shown in figure *l*, and I think no illustration of it has been published before. The specimens (*Hicoria alba*) were collected by Mr. Percy Wilson in 1901, near the N. Y., N. H. & H. R. R. station at Baychester, New York. Dr. Hollick's description is sufficient for these specimens.

Ascidia in Clover. —The formation of pitchers in clover is so common that the instance here figured (fig. *f.*) is referred to primarily because it was stated by the pupil who collected the specimens that every leaf of the plant which bore them possessed ascidia. I did not have the opportunity to observe the plant personally. In "Die Mutationstheorie" (**1**: 641), it is stated that *Trifolium repens* in the garden forms ascidia only in spring, the pitchers preponderating on the first leaves of the shoot. Mulder (Tidjschr. Natuur.-Gesch. en Physiol. **6**: 109. 1839) describes and fig-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ures (Pl. V, f. 1) leaves of *Trifolium repens*, in one of which the middle leaflet is small and dwarfed; in a second this leaflet is modified as an awn; while in a third it appears as a stalked ascidium, very similar to the one here figured. Two other points are of interest in connection with the instance here figured. First, the character of the almost sessile pitcher in the leaf that has two, where the margins adhere only at their distal portions. Second, the fact that the ascidia are supernumerary leaflets. If they were removed the leaf would still possess the number of parts normal for the species (*T. repens ?*).

Ascidia in Licorice. — So far as I have been able to find, pitcher-formation has not been previously recorded for the licorice (*Glycyrrhiza glabra*). By inspection of figure *g* it is seen that one leaflet of the fourth pair from the base is a shallow ascidium.

Fasciation in the Honey-locust. — In his "Éléments de Tératologie Végétale" (Paris, 1841, p. 149) Moquin-Tandon, speaking of fasciation in woody dicotyledons, includes the *fevier*, or *Gleditschia* in his list. According to Penzig (Pflanzen-Teratologie, p. 407), Camus recorded fasciation in the variety *inermis* (Anomalie e varieta nella Flora del Modenese. Terza contribuzione Rendiconti della Soc. dei Naturalisti dei Modena. Ser. III, 3. 1886). I have never seen this fasciation figured before. The specimen shown in figure *h* was brought to me by Miss Jean Broadhurst.

Tricarpellate English Walnuts. — Multiplication of the number of parts in the flower is of very common occurrence. Moquin-Tandon (*l. c.*, p. 354), however, called attention to the fact that polyphylly of the gynoecium is more rare than suppression of the organs, on account of the pressure of adjacent parts. Masters (*l. c.*, p. 363) adds that the later development of the carpels is also a factor here. He gives a list of eighty-nine genera in which supernumerary carpels have been observed, and states that the phenomenon is most common in Cruciferae, Umbelliferae, and Liliaceae. Among some English walnuts (*Juglans regia*) recently purchased at a store, two or three nuts were found to have three carpels (see figure *l*) instead of the usual two. While such a thing is common in plants, *Juglans regia* is not included in the

list given by Masters, and I have not seen such a case reported for that species.

A Two-headed Daisy. — The doubling, and even the tripling of the heads in the ox-eyed daisy (*Chrysanthemum Leucanthemum*) and in the dandelion (*Taraxicum Taraxicum*), and other Compositae and Chicoraceae has been often recorded. It is thought, however, that the instances here figured will be of sufficient "popular" interest to justify their mention in TORREYA. The specimens were sent me by Professor Margaret C. Ferguson, of Wellesley, and clearly show three types of the double head. In figure *a* the two heads are quite distinct on the common stalk, directly opposite each other, and forced by their mutual crowding to grow with the discs nearly vertical, instead of horizontal as normally. In *b*, the two heads are more closely united, while in *c* the fusion is complete, giving the appearance of an elongate and abnormally large inflorescence. The groove in the center of the disc is characteristic of such sports. In each case the peduncle was fasciated throughout its entire length. These double heads are not uncommon in the *Rudbeckia*, or yellow daisy.

Fasciation in Delphinium. — Abnormalities in the inflorescence of the lark-spur are of several varieties, and much of the literature is cited by Penzig. One of the earlier references to the subject is that of Fermond who, in his "Essai de Phytomorphie" (**2**: 321. Paris, 1864), described a variation in the inflorescence of *D. ajacis* analogous to "cyclochorize pollaplasique." The accompanying illustration, figure *d*, shows four flower-clusters collected in the New York Botanical Garden in the summer of 1907. At the left is a normal inflorescence, in striking contrast to which are the three fasciations at the right. All of the individual flowers appeared to be normal.

NEW YORK BOTANICAL GARDEN.

SHORTER NOTES

Bird Nests from Jamaica. — On our recent trip to Jamaica we had the pleasure of going down on the same steamer with the ornithologist of the New York Zoölogical Park and his wife, and spent one delightful afternoon together at Hope Gardens, among the flowers and the birds. The humming-birds are always the most attractive visitors to the flowers of the tropics and are naturally very much admired. I made an effort to secure the nests. That of the "doctor-bird," *Aithurus polytmus*, a large black humming-bird with two long tail feathers was sent to me from Cinchona where it was found suspended from the leaves of the pampas grass and is composed of the woolly scales of one of the tree-ferns, *Alsophila pruinata*. The outside is covered and bound together with a fine net-work of spider's web and ornamented with pieces of lichen. The eggs were white and fragments of them still remain in the nest. It measures 2 ½ inches in depth on the outside and 1 inch inside, is 6 inches in circumference and 1 ½ inches across the top and is wonderfully soft and light and a rufous brown color.

The humming-birds are particularly fearless and numerous in Jamaica and visit the flowers in the drawing-rooms daily, scolding if your presence annoys them and fluttering over your head. One of them attempted to make its nest in a vase of flowers at "Bullstrode" near Grange Hill.

We also have a nest of the Jamaica swift made of the down from various species of *Tillandsia*, presented to us by T. B. Sturridge, Esq., of Union Hill.

Elizabeth G. Britton.

Notes on Rutaceae.— **Xanthoxylum Nashii** Wilson, sp. nov. A prickly shrub or small tree 3–4.5 m. high, with slender grayish branches; young twigs light gray, verrucose-glandular; stipular prickles in pairs, numerous, slender, straight or slightly curved, spreading, chestnut-brown, becoming gray with age; leaves odd-pinnate, 0.5–1.5 cm. long, the petioles, and rachis (if present), narrowly winged; leaflets 3, occasionally 5, obovate, truncate or rounded and often emarginate at the apex, cuneate at the base, minutely and often obscurely crenulate above the

middle, equilateral or occasionally inequilateral, sessile or subsessile, glabrous, coriaceous, lustrous above, pellucid-glandular, the glands few, scattered, the marginal glands larger; lateral leaflets 2.5–7 mm. long, 1–4 mm. broad, the terminal leaflet somewhat longer and broader; flowers not seen; calyx from under mature carpels, 1.5–2 mm. broad, the sepals 5, entire or denticulate; fruiting inflorescence lateral, sessile or subsessile; capsules one to three, sessile, obovoid, compressed, 6–9 mm. long, 5–9 mm. broad, blackish or brownish, the surface wrinkled; seeds orbicular, compressed, often truncate at the base, 5–6 mm. long, black, shining, smooth or slightly wrinkled.

Type collected in a xerophytic region near Gonaïves, Haïti, *G. V. Nash 1579.*

Amyris texana (Buckley) Wilson, comb. nov.

Zanthoxylum texanum Buckley, Bull. Torrey Club **10**: 90. 1883.
Amyris parvifolia A. Gray, Proc. Am. Acad. **23**: 226. 1888.

Type collected by S. B. Buckley near Corpus Christi, Texas, April, 1882.

CASIMIROA EDULIS La Llav. & Lex. Nov. Veg. Descr. **2**: 2. 1825.

Zanthoxylum bombacifolium A. Rich. Ess. Fl. Cub. 329. 1845.
Fagara bombacifolia Krug & Urban, Bot. Jahrb. **21**: 567. 1896.

Sagra's specimen in the herbarium of the Academy of Natural Sciences, Philadelphia, agrees with Mexican material of *Casimiroa edulis;* the ovary in the Sagra specimen is abortive. It is very probable that the material upon which Richard based his *Zanthoxylum bombacifolium* was from a cultivated plant.

Specimens collected in Cuba by Bonpland and G. Don and referred by Dr. Urban to Richard's species have not been examined by me.

PERCY WILSON.

NEW YORK BOTANICAL GARDEN.

ANOTHER LEAF-SPOT FUNGUS OF THE APPLE. — During the past five years, I have been trying to find out what fungus it is that causes the defoliation of so many apple-orchards in West Virginia. An examination of hundreds of leaves from some of

the worst defoliated orchards shows that most of the fungi, heretofore associated with the defoliation of apple trees, were either not present or when present and even abundant did not bring about a defoliation. However, there was a fungus, one of the Tuberculariae, which was universally present in these orchards and occasionally on apple trees by the roadside. While I do not know that this fungus was primarily responsible for the defoliation, it caused a large amount of damage to the foliage. It was so plentiful in some orchards by the first of September that the lower branches of some of the trees were nearly defoliated, the remaining leaves being brown and crumpled.

The spots caused by this fungus are so different from the spots caused by other leaf-spot fungi of the apple that they can be readily recognized even when the fungus is not fruiting. In general, the spots are nearly circular, from five to fifteen millimeters in diameter, two or more frequently coalescing. In color, the spots are brown or brown mottled with gray, the two colors being arranged more or less concentrically or like contour lines on a map. In the center of some of the spots is a small gray or whitish spot, caused, perhaps, by a first infection of the leaf by some other fungus. The larger and encircling spots may, therefore, be due to secondary infection by the fungus under consideration.

The spore-fruits of the fungus might be easily overlooked, and probably have been, since they are on the under side of the leaf, of about the same color as the spots, minute, and hidden to a considerable extent by the pubescence of the leaf. The fungus is very similar to *Hymenula cerealis* E. & E. except that the sporodochia are considerably smaller (1 : 5) and the conidia a trifle plumper than those of the type specimen of *Hymenula cerealis* which I examined in the herbarium of the New York Botanical Garden. The shape and structure of the sporodochia are also more like those of an *Illosporium* than a *Hymenula*. On account of these differences, the name **Illosporium malifoliorum** n. sp. is tentatively proposed with the following description :

Spots suborbicular, or coalescing and becoming irregular, brown or sometimes mottled with gray and with a small gray

spot near the center, 5–15 mm. in diameter; sporodochia hypophyllous, minute, gelatinous, yellowish-amber and blackening, subspherical when moist (150 μ) becoming disc-shaped or irregular when dry (60–100 μ); sporophores branched; conidia hyaline, oblong, 1×3.5–$4\ \mu$.

While examining specimens of other apple leaf-spot fungi in the herbarium of the United States Department of Agriculture, I came across this same fungus on a few leaves among specimens determined as *Phyllosticta pirina* Sacc. and collected by M. B. Waite at White Sulphur Springs, W. Va., and A. R. Blakely at Springdale, N. C.; in 1889.

JOHN L. SHELDON.

WEST VIRGINIA UNIVERSITY,
MORGANTOWN, W. VA.

REVIEWS

Grout's Mosses with Hand-Lens and Microscope*

Part IV. of Mr. Grout's " Mosses with Hand-Lens and Microscope" equals the previously-issued parts in good type, excellent paper, and numerous, clear illustrations. More detailed explanations might well be given some of the full-page plates, remarks are too often included in the generic and specific descriptions, and the descriptions could be more readily compared if the same arrangement were regularly used; however, the "non-technical" character of the book as announced on the cover page is undoubtedly the author's justification for his treatment of the subject. Numerous short keys are given; these with the excellent illustrations should make the identification of our common mosses a very simple matter.

The Guide to Nature and to Nature Literature†

"The Guide to Nature and to Nature Literature," mentioned in the last issue of TORREYA, began publication with the April number. It is an "Illustrated monthly magazine for adults, de-

* Grout, A. J. Mosses with Hand-Lens and Microscope. Part IV. Pp. 247–318. pl. 56–75. figs. 134–195. Published by the author, Brooklyn, New York, 1908. $1.25.

† The Guide to Nature and to Nature Literature. Magazine. Illustrated. Official organ of the Agassiz Association. Editor, Edward F. Bigelow, Stamford, Connecticut.

voted to common-place nature with uncommon interest." It is also the official organ of the Agassiz Association, "the oldest, most extensive and most efficient organization in the promotion of the love and knowledge of nature."

The lack of a table of contents is less keenly felt by reason of an ingenious system of general headings spread through the text at irregular intervals. There are eleven of these, one temporarily without material to fill it, and their diversified character speaks volumes for the future scope and usefulness of "The Guide." It is unnecessary to enter into the details of all these divisions, but a few deserve passing mention.

Under the caption, "The Outdoor World," is an article by Professor Earl Douglas on fossil hunting, and another on "Our Eastern Calla Lily." In the latter the propriety of coining this new common name for the well-known skunk cabbage may be questioned. The attempt to attach a name long associated with *Zante deschia* to *Spathyema foetida* is justly doomed to failure. For common names are not made in an editor's office. They are rather the product of long years of a popular tendency to attach definitive names to the better known plants and animals. Under "Domesticated Nature" there is an interesting article on the origin of the Easter egg and Easter rabbit custom. In a slightly similar vein are "A Tendril Soliloquy" and a group of "astonishing experiences" with foxes. The correspondents submitting the latter have done the editor a very perilous service, for the strain on the reader's credulity is great, and recent press discussion of such "astonishing experiences" has been exceedingly keen.

"The Camera" affords an illustrated article on "Interesting Cloud Effects" and also a good description of a home-made photomicrographic apparatus. The photographs under "Bird Haunts" seem to lack significance, since there is no visible sign of a bird or a bird's nest.

"The Twin Periodicals" is an editorial confession of faith and it is in this that we find what is to be the future scope and ideal of "The Guide." After a gentle criticism of two widely known magazines devoted to outdoor life in America, and the expres-

sion of a pious hope that "The Guide" will not follow their habit of "delineating a metropolitan wealth," we read the following: "It will not deal entirely nor frequently in 'glittering generalities,' although it hopes to sparkle sometimes, and at all times to glow steadily with the fire of nature's inspiration, fanned by the breezes that swing above the fields and toss the clouds across the sun. The sight of a leaf lying on a cluster of bluets in a grassy meadow will be more welcome, and will more thoroughly merit a full-page illustration, than will a thousand fur rugs of (*sic*) a roomful of priceless tapestries. It will be a guide to nature, not a sign-post to point out the useless things that unlimited wealth can buy. A description and picture of an invisible object as it appears under the microscope will give 'The Guide' greater satisfaction than the portraits of forty bulls of Bashan." Thus Mr. Edward F. Bigelow, editor.

The whole tone of the paper is one of enthusiastic love of nature, and this will almost atone for distressing shortcomings. The task of bridging the gulf between the natural scientist and the general reader is always difficult. There is the tendency on the one hand to write dry facts in a colorless style; on the other to dispense highly readable but dangerously colored "Nature Faking." It would be a delirium of optimism to expect "The Guide" to bridge successfully this gulf, for bigger and stronger efforts have failed. But an editorial enthusiasm that allows the publication of "astonishing experiences" with foxes will be nothing daunted by the failure of previous efforts. And it is a matter for congratulation that an editorial assurance which sees no very urgent necessity for apologies for this first issue, did not turn out something much worse.

There is doubtless room for a paper that will print nature items of "uncommon interest." And an editor who can improvise upon the theme of a climbing tendril is sure to please a certain class of readers. But neither of these facts would seem to furnish any very vigorous reason for the existence of "The Guide" as an interpreter of either the esthetic or scientific phases of nature work.

The magazine is a well-printed and illustrated sheet of thirty-two pages with the usual advertisements. NORMAN TAYLOR.

PROCEEDINGS OF THE CLUB *

May 12, 1908

The Club met at the American Museum of Natural History at 8:30 o'clock. In the absence of the President and both Vice-Presidents, Dr. N. L. Britton was called to the chair. Sixty-five persons were in attendance.

After the reading and approval of the minutes for April 29, 1908, the Club listened to a very interesting lecture on "Wild Flowers of Spring," by Dr. N. L. Britton. The lecture was illustrated by lantern slides made by Mrs. Cornelius Van Brunt, illustrating in natural colors the flowers of the local spring-blooming plants.

Adjournment was at 9:30 o'clock.

C. Stuart Gager,
Secretary.

OF INTEREST TO TEACHERS

The sixth question of the list given in the March Torreya was discussed in the April issue; below are other letters of interest which bear upon the same question: Why does not the study of high school botany more often create a lasting interest? Would this be secured by more emphasis on morphology, including classification?

I

The popularity of such books as How to Know the Wild Flowers and the many guides to trees, ferns, etc., shows very plainly the trend of common interest in the subject. I cannot at this moment think of one popular guide to experiments with plants such as we find for physics or chemistry.

Plant study presents itself to me in three important phases; in the first the plant may be viewed as a living organism whose structure and activities may be studied from about the same standpoint as that of the animal (human) body. Beyond general facts this study will be pursued by few other than specialists. We shall take the facts as we find them (about as we do those of

* The proceedings for April 29 will be given in the July number.

human physiology) and expect the specialists to set us right from time to time.

Another phase which seems to me important is a knowledge of plants as national resources — their relation to great human interests. The forest service and agricultural work keep us in touch with this.

The other side is the study of our own plants — their variety and beauty as we find them. If this is is carried on out of doors — as most of it should be — and sufficiently to make children really intelligent — the interest ought to be lasting because this is an accessible field for study. It seems to me that more guides and keys would greatly aid in this work.

ANNA CLARK.

THE NEW YORK
TRAINING SCHOOL FOR TEACHERS.

II

If it is not too late, I should like to enter the discussion of the interesting topic presented in your Teacher's Department in April. Your question, "Why does not the study of botany more often create a lasting interest?" suggests that somehow botany is inferior to other subjects in establishing permanent interest in high school pupils. I know that this is the prevailing opinion regarding science subjects in general, and the biological in particular; but my observations lead me to disagree with it decidedly. I think your question might be fairly answered by asking a similar one, namely, why do not secondary school subjects in general more often create a lasting interest in the minds of pupils? I do not mean to say that I think there is no possibility for improvement in botany and other subjects, so far as arousing interest is concerned; but I am inclined to think that we sometimes expect too much when we look at botany in the secondary school from the standpoint of our experience as professional biologists. We must sooner or later begin to recognize the fact that a large proportion of people are not and probably cannot be prepared to view the world through the eyes of the naturalist, and hence I think it is not to be expected that a very large proportion of

pupils should gain from the high school study of botany an abiding and enthusiastic interest in the subject. For my part, I am very much more interested in the question whether high school botany so influences the mental habits and outlook of pupils that by this study they are made citizens of more general culture and ability; and the question whether or not they remain enthusiastic students of botany as such seems to me to be one of decidedly minor importance. As an illustration, I look back upon my own high school work in languages and mathematics as the most profitable work in my preparation for college, and yet if my present interest in these subjects is to be judged by the amount of time which I have given to them in the last ten years I think I might reasonably ask why did not my high school studies of languages and mathematics create a more lasting interest? The question of apparent interest is largely determined by the future application, and it has happened that I have had no particular demand for direct application of my high school Latin and Greek and mathematics. However, I can trace quite definitely in my own mind the valuable influence of such study upon my college and later work and hence I feel satisfied that the general educational value of the languages and mathematics study in the high school was a sufficient justification of their presence in the curriculum. I am forced to apply the same line of reasoning to science in the high school, and hence I fail to see that we can judge the value of a high school course on the basis of the pupils' lasting interest in the subject-matter of the sciences studied.

M. A. BIGELOW.

TEACHERS COLLEGE, COLUMBIA UNIVERSITY.

III

Before attempting to answer the question why the study of botany in the high school does not more often create a lasting interest in the subject, it may be pointed out that no other high school subject is better circumstanced in this respect. In fact, if we compare the interest taken in botany, aside from any money there may be in it, with similar interests in chemistry, physics, geology, or zoölogy as a whole, we shall find that botany is far in the lead.

The question, then, looked at from a different angle, reads "How can the lead which botany has over other studies be increased?" For the purposes of our inquiry we may divide all who are interested in botanical pursuits into two groups — the botanists and the botanizers. The botanist I would define as a person interested in the science of botany, the botanizer as one interested in plants without much interest in or regard for the science. It requires a peculiar type for the botanist. He must have an inquiring turn of mind, a love of study, a respect and regard for knowledge and an irresistible persistence in delving into the secrets of nature. It may be doubted whether this type of mind can be developed by any sort of schooling in individuals in whom it is not latent. This is why your good botanical pupil ceases to be interested as soon as the course is finished and also why some individuals with few or no advantages force their way to the front. The latter are botanists, born; the others are not. Occasionally the schools succeed in making a good imitation botanist, but the spurious article is easily detected.

The botanizer has but a passing interest in the studies of the botanist. He is attracted to botany by the love of beauty and the joys of discovery. The bright hues, pleasant perfumes, and varied forms of the flowers appeal to his senses and incline him to make a collection, while his wanderings afield are principally to find a new flower, a flower newly in bloom, a plant in a new place, or a new combination of plants. The spirit of discovery animates both botanist and botanizer, but each applies it in a different way. The botanizer asks for the name of a new flower, where it grows, when it blooms and what it is good for, but he is seldom interested in its marvellous devices for pollination or seed-dispersal and mere weeds do not attract him unless they have showy flowers.

There seems to be very little change needed in high school courses designed for the education of the botanist. With almost any kind of a start he may be depended upon to take care of himself, but if we are to cultivate the botanizer — and there is an immense number of his kind — very radical changes must be made. We seldom realize how many people there are interested

in plant life without making pretentions to being botanists. Four hundred and ten thousand are on the subscription lists of Park's Floral Magazine — a publication that doubtless the majority of botanists never heard of, though it is one of the oldest of our botanical publications. One hundred and seventy-five thousand subscribe to Vick's, Floral Life has 100,000 more and the Garden magazine has 50,000. If we should include publications devoted to farming and gardening still more astonishing figures could be secured.

I am convinced that this is the side of botany that high schools will find most worth while to cultivate. It can be, and is being, advanced by means of school gardens, horticultural and floricultural courses, courses in structural botany and studies in the flora of the surrounding region.

The reason for lack of apparent interest in college is not difficult to find. Since the motto of the present generation is money first and culture afterward, botany, which can offer no such lucrative inducements for its study as can the mechanical and physical sciences, is naturally passed by. The intelligent person, however, who realizes that making a living and enjoying a living are two different things, will continue to take up botany and every wise teacher will encourage him to do so by every means in his power.

WILLARD N. CLUTE.

JOLIET HIGH SCHOOL,
JOLIET, ILLINOIS.

The Museums Journal of Great Britain for March contains an article by G. A. Dunlop which describes "Drying Plants without Pressure" by the use of fine sand or boxwood sawdust, the latter material preserving many of the natural colors and much of the texture of flowers and leaves.

Seven of the "Tabulae Botanicae" by the Berlin publishers, Gebrüder Bornträger have been completed. The charts are large, with clear, accurate figures, and helpful text printed in German, French, and English. The figures are not the ones so commonly used in text-books. One chart illustrates stomata; the others are devoted to the moulds and the myxomycetes.

Among the papers included in the Annual Report of the Director of Botanical Research in the Carnegie Institution (Dr. D. T. MacDougal) for 1907 are "The Advance and Recession of Vegetation in the depressed Basins of the Colorado Delta," "Acclimatization," "Distribution and Movements of Desert Plants," "The Topography of Chlorophyll Apparatus," "Physiology of Stomata," "Evaporation and Plant Distribution," and "The Relation of Evaporation to Plant Activity."

The New York *Tribune* prints a timely remonstrance on its editorial page: "Arbor Day, more suitable in this region for the cultivation of aquatic plants by amphibians than anything else, is past and gone. It would be interesting to know whether it saw more trees planted or destroyed. For while school children and others were busy with spade and shovel the trolley folk and electric linemen were also active, and the work of wires already strung in chafing and burning and mutilating trees by the roadside went steadily on." It may seem futile to add one more thing to the rapidly expanding school curriculum, but an Arbor Day that does not include the phase of tree preservation suggested by the *Tribune* falls far short of the needs of to-day.

G. P. Putnam's Sons have recently published "The Alpine Flora of the Canadian Rockies" by Stewardson Brown and Mrs. Chas. Schaeffer. Dr. Brown is responsible for the text and Mrs. Schaeffer for the unusually fine colored illustrations which have been prepared from her photographs and water color paintings. The book is designed to meet the needs of tourists in the Canadian Rockies and is therefore popular rather than purely scientific in its character. Although our imperfect knowledge of the flora of the Canadian Rockies makes impossible at this date a complete flora of that region, a catalogue of distinct value to the botanist was published last fall by the University of Pennsylvania under the title "Contributions to a Catalogue of the Flora of the Canadian Rocky Mountains and the Selkirk Range" by Edith M. Farr.

CAROLINE ROMER.

NEWS ITEMS

Victor E. Emil, Ph.D., of the Harvard Medical School, has been appointed instructor in biology at the George Washington University.

Mr. Chas. T. Vorhies, of the University of Wisconsin, has been elected to the chair of biology in the University of Utah.

Professor John M. Macfarlane, professor of botany in the University of Pennsylvania, has returned from a collecting trip in the Gulf states.

Dr. S. O. Mast, Johnston professor of biological science at Hope College, has been appointed associate professor of biology at the Woman's College of Baltimore.

Dr. Clifton D. Howe, associate director of the Biltmore Forest School, Biltmore, North Carolina, has accepted an appointment as lecturer in forestry in the University of Toronto.

The Summer School of the Connecticut Agricultural College, which holds its seventh annual session July 1 to 24 inclusive, offers special courses in nature study and elementary agriculture. The school is planned to meet the needs of teachers and others interested in outdoor life.

E. C. Parker, assistant agriculturist at the Minnesota Experiment Station, will sail on June 30 to become expert adviser to the government officials of Manchuria. With W. H. Tombave, now connected with the University of Pennsylvania, he will be employed in instituting modern methods of agriculture in Manchuria.

Dr. Charles A. Kofoid, associate professor of histology and embryology in the University of California and assistant director of the San Diego Marine Biological Laboratory, has been granted leave of absence and will spend the coming academic year in Europe, principally at Munich and Naples. He will also deliver lectures in Liverpool and London.

Professor Leslie A. Lee, of Bowdoin College, who is noted especially for his research expeditions in Labrador and South

America, died May 20, at the Maine General Hospital. He was born at Woodstock, Vermont, in 1852. Since 1881 he had been professor of geology and biology at Bowdoin College, also instructor in geology and evolution at Bangor Theological Seminary.

A special summer meeting of the American Association for the Advancement of Science will be held at Hanover, New Hampshire, from June 29 to July 3, 1908, in the buildings of Dartmouth College. Section G may hold no sessions, but full information as to program, railroad rates, and hotel accommodations may be obtained from the secretary, Dr. L. O. Howard, Smithsonian Institution, Washington.

By arrangement with the Bermuda Natural History Society, the Station for Research at Agar's Island will be open for about seven weeks this summer. There are accommodations for a limited number of instructors or research students in either zoölogy or botany. Steamers leave June 16 and June 30, thus making possible sessions of 48 or 34 days; the cost of passage, board and lodging will be $110, or for the shorter session, $90.

The fifth annual field "symposium," in which the Philadelphia Botanical Club, the Washington Botanical Club, and the Torrey Botanical Club will coöperate, will be held at Georgetown, Delaware (vicinity Lewes, Rehoboth, and Indian River), July 1 to 8, instead of July 6 to 12, as announced previously. The change was made for those having a short holiday on the Fourth. The headquarters will be at the Eagle Hotel, the rates being $1.50 per day (perhaps less per week).

The Conference of Governors on the Conservation of the Natural Resources of the Country, held in the White House, May 13–16, was followed closely by appropriate Congressional action; measures have been adopted for the appointment of a commission to go over the ground and report as to the necessity and cost of such reserves. It also gives the consent of Congress to states which desire to coöperate with the government in conserving their natural resources and protecting their navigable streams. The resolutions framed by the governors included the

following paragraph of especial interest to botanists: "We urge the continuation and extension of forest policies adapted to secure the husbanding and renewal of our diminishing timber supply, the prevention of soil erosion, the protection of headwaters, and the maintenance of the purity and navigability of our streams. We recognize that the private ownership of forest lands entails responsibilities in the interests of all the people, and we favor the enactment of laws looking to the protection and replacement of privately owned forests."

The American Association for the Advancement of Science which meets in Baltimore for the June convocation week will devote one day to the celebration of the centennial of the birth of Charles Darwin (February 12, 1809) and the semicentennial of the publication of the "Origin of Species" (November 14, 1859). The program so far as arranged contains the following appropriate titles: "Natural Selection from the Standpoint of Zoölogy," by Edward B. Poulton, Oxford University; "Natural Selection from the Standpoint of Botany," by John M. Coulter, University of Chicago; "The Direct Effect of Environment," by D. T. MacDougal, Carnegie Institution of Washington; "Mutation," by C. B. Davenport, Carnegie Institution of Washington; "The Behavior of Unit Characters in Heredity," by W. E. Castle, Harvard University; "The Isolation Factor," by David Starr Jordan, Stanford University; "Adaptation," by C. H. Eigenmann, Indiana University; "The Bearing of Recent Cytological Studies on Heredity and Evolution," by E. B. Wilson, Columbia University; "Evolution and Psychology," by G. Stanley Hall, Clark University; and "Recent Paleontological Evidence of Evolution," by Henry Fairfield Osborn, Columbia University. It is proposed to print these addresses in a volume to appear during the centennial year.

Dr. C. Stuart Gager, director of the laboratories of the New York Botanical Garden since February 1, 1906, has accepted the appointment of professor of botany in the University of Missouri, at Columbia, Mo. The above will be Dr. Gager's address after September 1, 1908.

TORREYA

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SUGGESTIONS FOR FUTURE WORK ON THE HIGHER PLANTS IN THE VICINITY OF NEW YORK *

By Roland M. Harper

New York is one of Nature's strategic points. Three very important and entirely independent physiographic lines which do not intersect at any other one point, namely, the terminal moraine, the fall-line, and the coast line, pass right through the city, which therefore includes within its limits parts of the ancient highlands founded on solid rock, the unconsolidated coastal plain, and glaciated and unglaciated portions of both, as well as the beaches, dunes, and marshes of the coast itself, which is as distinct from the coastal plain as that is from the highlands. There is probably not another spot in North America, if in the world, which exhibits so much natural diversity in its immediate surroundings. Within fifty miles of here are considerable areas of Archaean, Palaeozoic, and Triassic rocks, some of them forming considerable mountains, as well as the nearly flat expanse of the Cretaceous and Tertiary coastal plain of Long Island and New Jersey, some of it covered with pine-barrens and some with fine oak forests. A circle with New York as its center and a radius of 100 miles, as shown by the Preliminary Catalogue of Anthophyta and Pteridophyta published by the Club in 1888, includes over half the species of vascular plants credited to the northeastern United States and adjacent Canada.

The earliest botanists in this rich region had their hands pretty full with merely collecting, identifying, and enumerating the flowering plants they found. Many species were at once seen to be new to science, and such had to be carefully compared and described;

* Read at a meeting of the Torrey Botanical Club, April 29, 1908.

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though most of the describing was done by European botanists up to about a hundred years ago. Others which were at first supposed to be identical with species already known from the Old World were gradually segregated and described as new. But by the middle of the nineteenth century the supply of new species of flowering plants and ferns in this part of the country had been almost exhausted, except in a few difficult groups which were beyond the comprehension of the average student. Even as far back as 1829 Amos Eaton made this statement in the preface of the fifth edition of his Manual of Botany: "There is not, probably, 50 undescribed species of Phenogamous plants in the United States — perhaps not one species, east of the Mississippi." (He lived to see the utter fallacy of this estimate, however.)

At an early period in the history of American botany, the recording of new localities for rare plants, and preparing floras of certain limited areas, became the favorite pursuits of the more ambitious amateurs, and the first few volumes of several of our best-known botanical journals were very largely devoted to studies of this kind. Good work in regional botany is still being done, but in this part of the country it is now hardly possible to prepare a "local flora" of the ordinary type without repeating a great deal that has already been published.

In the latter part of the 19th century many botanists who possessed the necessary training and equipment became diverted into the comparatively untrodden fields of anatomy, physiology, pathology, and cryptogamic botany. The opinion was expressed by a prominent botanist in a public address about twenty years ago that in the Eastern United States the non-professional botanist, without extensive library and herbarium facilities, could make the best use of his time available for research by studying the histology and development of particular plants. This kind of work is indeed valuable when well done, and the field is well-nigh inexhaustible, but the technique required for its successful prosecution places it beyond the reach of most of us.

The nomenclature agitations which began in this country about twenty years ago contributed hundreds of pages to botanical literature, and kept all classes of botanists busy for awhile learn-

ing new names in rapid succession. By the time comparative calm was restored, ecology came into prominence, and opened up a vast field for botanical research, which was quickly taken advantage of by many young students and even a few of the older men who had been trained in the herbarium or "lie-flat" school. (Up to this time, it should be observed, plants had been studied separately, *i. e.*, without reference to environment or associates, by systematist, phytogeographer, and physiologist alike.) But the fact that this new branch of science was soon invested with technicalities, and studied with the aid of elaborate apparatus, doubtless deterred many amateurs from following it. There was also a feeling in some quarters, especially in the eastern strongholds of conservatism, that ecology contained nothing new, that it was merely a rehashing of old facts which had long been known to botanists. And indeed it has not produced the striking results that some of its enthusiastic advocates expected it would, and in the last two or three years there has been a perceptible falling-off in the number of papers annually devoted to it.

Since the beginning of the present century the problems of mutation, hybridization, and experimental evolution have given occupation to a few specially trained investigators, and their work promises to be of great economic as well as scientific value; but it calls for persons of exceptional talents who are able and willing to spend years on a single problem before announcing results, and it has not measurably increased the opportunities of the amateur as yet.

At the present time nearly all the American botanical literature of permanent value is being produced by persons officially connected with museums, laboratories, and other institutions of research, or in other words, by professional botanists; but there is no sufficient reason why this state of affairs should continue indefinitely. Notwithstanding the serious inroads of civilization around New York, and the vast amount of work which has already been done on the plants of this vicinity in field, herbarium, laboratory, and library by several generations of the best-trained botanists in America, there are still awaiting solution here innumerable botanical problems which can be successively attacked

by any one possessed of a manual, a fair knowledge of plants, and a little spare time and perseverance. Some of them are distinctly outdoor problems, while others are of a statistical nature, and can be studied at home in winter and inclement weather, with the aid of field notes and a few books. For the amateur who wishes to make his work count the occasional assistance of a person familiar with botanical literature, to prevent duplication of research, is eminently desirable, but that is easily obtained in such a botanical center as New York.

Botanical field workers have always been inclined to pay too much attention to rarities, like mere curio collectors; and although it cannot be denied that finding rare plants is one of the botanist's chief pleasures, at the same time we can generally learn more from the common ones. It is really more important to determine what species are most abundant in a given region or plant association than to discover the rarer ones or even to make a complete list. Besides the common and rare plants there is another important category, commonly overlooked because they cannot be collected nor usually recorded in the field; namely, species which are absent from a given area or habitat and present in similar or neighboring areas.

In preparing local floras we should not be content with merely enumerating localities and habitats, unless the area is very small or very homogeneous. In a region with geometrical or political boundaries the distribution of each species should be correlated as far as possible with that of the various environmental factors, such as climate, altitude, geology, topography, etc. For instance, in this vicinity *Ilex glabra* seems to be confined to the coastal plain, *Quercus Prinus* to hilly or rocky regions, and certain ferns to limestone; while many species skip the pine-barrens, others do not grow near salt water, etc.

Most field botanists, especially in the northeastern states, have hitherto studied floristics rather than vegetation. The relations between these two concepts are analogous to those between orthography and grammar, grammar and literature, chronology and history, census statistics and geography, anatomy and physiology, or anthropology and sociology. In other words, while

the first is almost essential to the second, the second is far more interesting and valuable.*

The portions of the Eastern United States whose vegetation has been described in anything like a thorough manner at present constitute scarcely one per cent. of the whole, and, curiously enough, descriptions of vegetation are scarcest for some of the states in which botanists are and always have been most numerous. The plant habitats of the vicinity of New York are almost as little understood to-day as the plants themselves were in the time of Linnaeus, and even in some of the latest systematic works habitats are treated as unscientifically as plants are in non-botanical literature.†

North of latitude 35° and east of the Mississippi River no systematic classification of habitats seems to have yet been attempted for an area as large as a whole state,‡ though it would be a far simpler task to classify the few score of habitats in this part of the world than it has been to classify the several thousand species of plants.

An adequate description of a habitat would require as many words as a plant description, and would be out of place in the literature of systematic botany; but we should have a system which would enable us to designate any habitat accurately with not more than two or three words, just as a binomial or trinomial technical name suffices to designate any plant. Some ecologists believe that habitat names should be formed from the ancient languages, but it would seem as if our own language should be sufficient for the purpose, and that too, perhaps, without coining any new words. Of course there are now many short habitat names in common use, just as there were plant names before the days of systematic botany, but most of these are used rather

* For brief but illuminating comparisons of floristics and ecology see Clements, Research Methods in Ecology, 7–9, 1905; Bray, Bull. Univ. Tex. 82: 59–60. (Distribution and adaptation of the vegetation of Texas) 1907.

† See in this connection W. M. Davis, Am. Nat. 23: 579. 1889.

‡ An excellent beginning in classifying the vegetation of a small part of New England, with the novel feature of keys and descriptions for the habitats, was made by J. W. Blankinship in Rhodora for May, 1903, but it has not yet been followed up by any one else in that region.

loosely, and need to be given greater precision. For instance such familiar expressions as thicket, copse, glade, swale, grove, meadow, pine-barren, marsh, swamp, pond, sand-plain, and rich woods have never been adequately defined in terms of physiography, soil, and vegetation.

Photographs of vegetation are even scarcer than descriptions. Those for Connecticut, New York, and New Jersey which have hitherto appeared in botanical literature can almost be counted on the fingers, while some of the newer and more thinly settled states, such as North Carolina, Florida, Michigan, and Illinois, can make a much better showing in this respect. If members of the Club who possess the necessary apparatus would preserve records of the aspects of some of the natural habitats in this vicinity which are fast disappearing they would render a service of inestimable value to science.

As examples of natural vegetation within easy reach, the dunes and marshes of our coast are still in very nearly the same condition as they were a thousand years ago, and they offer a fertile field for study. We have as yet practically no description of any strand vegetation between Sandy Hook and the Bay of Fundy. The Palisades, which are almost in a class by themselves, have been greatly neglected by botanists. The largest natural body of fresh water and the highest hill on Long Island seem never to have been mentioned in botanical literature at all. The pine-barrens of Long Island and New Jersey have been damaged somewhat, but their original condition can be reconstructed fairly accurately. But all these places are being encroached on more and more every year, and they should be investigated without delay.

Turning to problems on a smaller scale, and perhaps more easily comprehended by beginners, it might be remarked that there is probably not one native species in North America whose average flowering period for any given locality has been determined within a week, and there are thousands of which we do not even know exactly the months in which their average periods begin and end. For most habitats we have only the vaguest idea of what proportion of the species are likely to be found in

bloom on any given date, or how long the flowering period of the average species in the habitat lasts, or at what hours the different flowers open and close,* which ones open only once and which open and close for several days in succession. These and numerous other phaenological problems which might be cited require no special knowledge for their investigation, and much can be done with them in a single season by any one who can get out in the field every week or so. For those who have some knowledge of entomology the study of the insect visitors of flowers presents an attractive field which has not been worked as much in this part of the country as it has farther west.

The exact mode of dissemination is practically unknown in many of our commonest plants, for example in such familar genera as *Panicum*, *Cyperus*, *Scirpus*, *Carex*, *Juncus*, *Polygonum*, *Hepatica*, *Potentilla*, *Lespedeza*, *Polygala*, *Lechea*, *Kneiffia*, *Convolvulus*, *Utricularia*, *Plantago*, *Ambrosia*, *Rudbeckia*, *Helianthus*, and numerous others easily recalled. And yet almost any plant ought to give up its secrets to the student who has patience enough to sit down beside it for awhile at the proper time.†

The local distribution of many species which reach their limits in this vicinity is very imperfectly known, even in the case of such common trees as *Pinus echinata*, *P. virginiana*, *Larix*, *Chamaecyparis*, *Quercus minor*, *Q. marylandica*, *Q. Phellos*, *Magnolia virginiana*, and *Liquidambar*.

A great deal of valuable information about the common names and economic properties of our native plants can still be obtained by going out in the rural districts and interviewing people who have never been influenced in any way by botanical literature.

* The time of opening and closing of flowers is not such a trivial matter as it might seem at first thought. It is one of the chief characters by which *Kneiffia* and *Oenothera* are distinguished, and it might prove equally useful in other groups which have not been so well studied.

† Such studies as these are commonly supposed to belong strictly to ecology; but would not systematic botany be considerably enriched if to the description of each family or genus could be added a few words concerning pollination and dissemination, instead of noting only such characters as are obtainable from herbarium specimens? As the mode of dissemination is usually the same throughout a genus, and even throughout some of the smaller families, such information would add very little to the size of our manuals, even if nothing of less importance was omitted to make room for it.

The character of some of the many unsolved botanical problems which confront us can perhaps be illustrated best by the following set of questions.* These are submitted with the assurance that answers to most of them have never yet been attempted, although they should present no great difficulties. Members of the Club who can suggest answers, or other questions of similar nature, are urged to do so.

What proportion of our local flora (or of the flora of any particular region or habitat) consists of trees? shrubs? vines? evergreens? parasites? annuals? biennials? anemophilous species? conifers? monocotyledons? grasses? sedges? Rosaceae? Leguminosae? Umbelliferae? Ericaceae? Compositae?

In what habitat or habitats is each of the above groups (or any other large group of plants) most prominent?

To what families and habitats do most of the plants belong that bloom in spring? summer? fall? What is the first spring flower in each habitat?

Why are some species common and some rare? Do the common and rare ones tend to belong to any particular habitats or taxonomic groups?

Do closely related species (not merely congeneric, but so close that no others come between) ever have the same range or habitat, or both? If so, do they ever grow close together? Give examples, if possible.

In what families and genera do natural hybrids occur?

Are two modes of dissemination ever found in the same genus? Give examples.

In what families, genera, and habitats do we find plants that perform sleep movements? Plants with fleshy or barbed fruits? With blue or red or odorous flowers? Carnivorous plants?

What weeds prefer roadsides? pastures? vacant lots? cultivated fields? abandoned fields? barnyards? burned areas? recent clearings? What proportion of annuals, biennials, and perennials in each habitat?

* Editor's note. — Here is abundant material for field work in our high schools, normal schools, and colleges. The questions will also prove suggestive for work during the long vacations which most teachers consider difficult to plan.

On Long Island what species grow only north or south of the "backbone" of the island? (A similar inquiry could be made relative to the terminal moraine in New Jersey and Pennsylvania.)

What species occurring at similar altitudes and latitudes on the mainland are wanting on Long Island, and why? What species native in Suffolk County do not grow in Nassau or Queens, and *vice versa?* To what families and habitats do such species mostly belong?

Why do a good many pine-barren plants occur in the eastern half of Long Island and not in the western half?

What native species and genera in our vicinity are common to the Pacific slope? the West Indies? South America? Europe? Asia?

What proportion are endemic to Eastern North America?

What proportion of the species in our local flora, or in the northeastern states, were known to Linnaeus? Michaux? Pursh? Torrey & Gray?

What proportion still bear the names that these authors used for them?

What species have their type-localities in this vicinity (or in any limited area, such as New Jersey)?

What new genera (if any) were discovered in the northeastern United States during the 19th century?

What geographical names in this vicinity were derived from native plants?

What are the natural (or prehistoric) habitats in this vicinity of *Pinus virginiana, P. Strobus, Juniperus virginiana, J. communis, Acorus Calamus, Spathyema foetida, Juncus effusus, J. tenuis, Andropogon scoparius, Panicum virgatum, Scirpus atrovirens, Carex lurida, Juncoides campestre, Smilax rotundifolia, Juglans nigra, Carpinus caroliniana, Betula populifolia, Quercus alba, Q. palustris, Q. Phellos, Morus rubra, Ulmus americana, Celtis occidentalis, Polygonum pennsylvanicum, Polygonella articulata, Claytonia virginica, Liriodendron, Ranunculus abortivus, Menispermum, Sassafras, Liquidambar, Rubus occidentalis, Potentilla canadensis, Prunus serotina, Cassia marilandica, Gleditschia, Robinia Pseudacacia, Acalypha virginica, Rhus hirta, R. glabra, Ilex opaca,*

Celastrus scandens, Sarothra gentianoides, Oenothera biennis, Isnardia palustris, Cornus alternifolia, Epigaea, Gaultheria, Fraxinus americana, Diospyros, Obolaria, Gentiana crinita, Bartonia, Asclepias syriaca, Convolvulus Sepium, Verbena hastata, V. urticaefolia, Prunella vulgaris, Linaria canadensis, Pedicularis canadensis, Melampyrum, Plantago Rugelii, P. virginica, Houstonia caerulea, Sambucus canadensis, Lonicera sempervirens, Micrampelis lobata, Specularia perfoliata, Ambrosia trifida, A. artemisiaefolia, Xanthium canadense, Eupatorium perfoliatum, Chrysopsis falcata, Solidago canadensis, Aster Novae-Angliae, Antennaria plantaginifolia, Anaphalis, Erechthites, and the various species of *Panicum, Chaetochloa, Carex, Sisyrinchium, Rubus, Fragaria, Crataegus, Viola, Physalis, Lactuca, Solidago, Euthamia*, and *Aster?*

Are *Pinus echinata, P. virginiana, P. Strobus, Larix, Picea, Tsuga, Eriocaulon decangulare, Betula nigra, Quercus acuminata, Q. Phellos, Morus rubra, Platanus, Prunus serotina, Rubus occidentalis, Acer saccharinum, A. pennsylvanicum, Diervilla* (and various other species) native on Long Island? If so, where? (Many supposed native species in other regions should be subjected to similar inquiries.)

Some of the above questions may seem at first to be of no earthly use, but if studied conscientiously their bearing on other important problems will become evident, and at the same time entirely unexpected lines of inquiry may be developed. All of nature's laws are worth knowing, whether they seem to have any immediate practical bearing or not. Of course most of us do not have much time for field work, but what time we do have might as well be spent in studying some of the newer phases of botany, and making distinct contributions to knowledge, as in merely collecting and identifying plants as our predecessors did a hundred years ago. If in all our field work the structures and adaptations of plants are studied in relation to environment and distribution many interesting correlations can be made, and we will gradually come to understand why each species grows where it does, which ought to be the aim of every field botanist.

The following discussions of the past, present and future prob-

lems of American botany will be found full of valuable suggestions along the lines above indicated. Most of them are public addresses by well-known men, and nearly all can be found in the library of the New York Botanical Garden. The arrangement is chronological.

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Farlow, W. G. The task of American botanists. Pop. Sci. Mo. **31**: 305–314. Jl 1887. Abstract in Bull. Torrey Club **14**: 173–174. Au 1887.

McCarthy, G. The study of local floras. Jour. Elisha Mitchell Sci. Soc. **4**^{2}: 25–29. 1887.

Coulter, J. M. The future of systematic botany. Proc. A. A. A. S. **40**: 293–304. 1892.

MacMillan, C. On the emergence of a sham biology in America. Science **21**: 184–186. 7 Ap 1893. (Discussed by four other persons in later numbers of the same volume.)

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Barnes, C. R. The problems and problems of plant physiology. Science II. **10**: 316–331. 8 S 1899; Proc. A. A. A. S. **48**: 263–288. D 1899.

See especially pages 327–329 and 282–286, on ecology and plant names.

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Trelease, Wm. Some twentieth century problems. Science II. **12**: 48–62. 13 Jl 1900; Proc. A. A. A. S. **49**: 249–272. 1901.

Underwood, L. M. The last quarter—a reminiscence and an outlook. Science II. **12**: 161–170. 3 Au 1900.

Hitchcock, A. S. A brief outline of ecology. Trans. Kan. Acad. Sci. **17**: 28–34. 1901.

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Trelease, Wm. The progress made in botany during the nineteenth century. Trans. Acad. Sci. St. Louis **11**: 125–142. 26 N 1901.

Haddon, A. C. The saving of vanishing data. Pop. Sci. Mo. **62**: 222–229. Ja 1903.

Spalding, V. M. The rise and progress of ecology. Science II. **17**: 201–210. 6 F 1903.

Ganong, W. F. The cardinal principles of ecology. Science II. **19**: 493–498. 25 Mr 1904.

Cowles, H. C. The work of the year 1903 in ecology. Science II. **19**: 879–885. 10 Je 1904.

Reed, H. S. A brief history of ecological work in botany. Plant World **8**: 163–170, 198–208. 1905.

Robinson, B. L. The problems of ecology. Cong. Arts & Sci. (St. Louis, 1904) **5**: (1–13). 1906.

Underwood, L. M. The progress of our knowledge of the flora of North America. Pop. Sci. Mo. **70**: 497–517. Je 1907.

Some suggestions as to interesting and unusual ways of working up a local flora can also be found in Beal & Wheeler's Michigan Flora (1892), and on the first thirty pages of Beal's Michigan Flora (Fifth Report Mich. Acad. Sci., 1904).

OTHER TERATOLOGICAL NOTES

By S. B. Parish

1. *Foliar fission in Polystichum munitum.*—A plant of this fern, growing in the San Bernardino Mountains, exhibited in its different fronds a wide range in the extent to which they were affected by fission. This was very slight in some, but in others the normal form of the pinnae was greatly modified. The accompanying figure, from a drawing by Mrs. C. M. Wilder, renders further description unnecessary.

2. *Polyphylly of the Gynecium in Washingtonia.*—The ovary of *Washingtonia* consists of three conjoined carpels uniting in a common style. In a flower of *W. gracilis* two such ovaries, entirely distinct throughout, were included in the same calyx.

This organ was consequently oblong in section, instead of circular, and it was irregularly 6-lobed in place of 3-lobed. The petals and stamens were broken off, so that their number could not be certainly ascertained, but apparently it was not augmented.

Foliar fission in *Polystichum munitum.*

The same monstrosity is common in southern California in budded peaches. As many as half the flowers on a tree may exhibit an increase in the number of pistils. Usually there are

two, but not seldom three, four, or five in number. In most instances but one matures. In these trees the petals are much reduced. In unbudded trees, which bear flowers having well developed petals, I have not observed this deformity.

3. *Syncarpy.*—Two flat, disc-like fruits of summer squash were united at the edges for the distance of about two inches, and thence by a narrow process running to the base. The two fruits were fully grown, and of equal size.

Syncarpy also occurs in the peach, but is confined, so far as I have observed, to the fusion of but two carpels. The sarcocarps are only imperfectly fused, being more or less separated by epidermis, although the general outline may be regular. The two putamens are united by their margins below, and are separate and divergent above. The seeds and seed-cavities are unconnected. This also has been observed only in budded fruit.

4. *Floral Deformations in Lepidium Menziesii.*—In each of two specimens of this plant, collected in the San Bernardino Mountains, the following deformations were present:

Some short branches terminated in naked condensed clusters of imperfect flowers, resembling minute cauliflower heads.

Other stems bore more diffuse clusters of fewer flowers, which were composed of organs resembling the filaments of stamens, destitute of anthers. These were white in color, indefinite in number, but mostly more numerous than the sum of the members of a perfect flower. Some were naked; others had small foliaceous green sepals, and these again were elongated and bract-like.

Below these terminal clusters the stems bore pedicellate flowers, as in normal plants, and of about the ordinary size, but also variously deformed. The two outer floral cycles were green and foliaceous. Some were oval and concave, the inner (petals) purple-margined; others were linear, or linear-spatulate, and up to 3 mm. long. In these flowers the inner cycles were either entirely wanting, or were represented by clusters of filaments, either sessile or elevated on a short prolongation of the axis; or they contained antheriferous stamens, the anther cells sometimes separated, or stamens which were more or less foliaceous.

Again, the stamens were entirely aborted, but the carpels were present, and then these were raised on a stipe, simulating the Capparidaceae. These carpels were short-clavate, divided nearly to the base, but not crested, two-celled, and infertile. Or the pistil was represented by a pair of opposed, separated, linear leaves, as much as 3–4 mm. long; or a pair of oblong, concave, foliaceous organs inclosing a pair of shorter linear leaves. In the last case the outer pair of leaves probably represent the capsule and the inner pair the seeds.

San Bernardino, California.

Britton's North American Trees*

This large volume is one of the numbers of the American Science Series that is being brought out by the publishers. The purpose of this new series is so commendable that a knowledge of it should be widely disseminated and brought to the attention of the American people generally. It is designed to produce a series of books that will make clear to those unacquainted with nature not only living things but at the same time give them an insight into the significance of their forms, their adaptive features and their relation to the environment. The scope of the series is indicated by such divisions as the following: I. Classification of Nature, II. Functions of Nature, III. Realms of Nature, IV. Working with Nature; V. Man in Nature and Evolution.

The Trees of North America comes under the first division in which group work of a similar character upon fishes, insects, seedless plants, mammals, and birds have already been issued.

In the volume under consideration attention is given to all trees growing independently of planting in North America, north of the West Indies and Mexico. Each species is illustrated by figures showing the important characteristics of the leaves, flowers, and fruit, by which they may be identified. A very considerable number of photogravures has been added to the above-mentioned illustrations showing the general appearance or habit of certain

* Britton, Nathaniel Lord, with the assistance of John Adolph Shafer. North American Trees. Large 8vo. x + 894. *f. 1–781.* 1908. New York. Henry Holt and Company. $7.

forms and also often revealing the associations and conditions under which these species live. These photographs for the most part are of exceptional excellence and their reproduction and printing represent the perfection of a most difficult feature of the book-making art. It is a great satisfaction to take up a book in which the details of a photograph have been brought out without recourse to the use of heavy, perishable, and glaring paper. Note should also be made of the line-work figures; especially those illustrating the cone-bearing trees which have been executed with unusual accuracy and skill.

The chief interest in the work is of course centered in the treatment that is accorded the 871 species that make up the body of the text. For clearness and simplicity of statement, for concise and logical presentation, these descriptions and discussions of the North American trees may be well taken as a model by future workers. While the characterization of the forms has been taken up in such a non-technical way as to make the work available to those not trained in botany, this treatment has not resulted in a superficial discussion. The work is thoroughly scientific and the botanist as well as the novice in the subject are alike indebted to the authors for this excellent presentation. The descriptions are very complete, consideration being given not only to the summer and winter appearance of the plant but a great deal of attention is devoted also to the distribution, habitat, and relationship of the native and naturalized trees to those of other countries. Consideration is given also to the physical properties of the wood and to its uses as well as to the various products that are of commercial importance in the arts, sciences, and in various industries. Very timely is the information given regarding the availability of various species for decorative purposes and landscape effects. It is very remarkable that American trees and shrubs have never received the attention in this respect that they deserve. We are constantly confronted in the public parks and private estates with European plants that could often be replaced with advantage by native species. It is encouraging that a few of our horticulturists are realizing the possibilities of this line of work and we feel sure that the North

American Trees will be instrumental in bringing about a wider cultivation of many of our native species.

A very valuable feature of the text that appears quite independent of the descriptions of the plants is the emphasis that is given to the salient and diagnostic characters by which they are readily known. This kind of assistance is of the highest value to the beginner and it would have been greatly appreciated if the features that really identify a form had been emphasized for every troublesome species. Very familiar forms like the red and the gray oak (*Quercus borealis*), the sugar and the black maple (*Acer nigrum*), or the shagbark hickory (*Hicoria ovata*) cause no end of confusion to the beginner owing to their variations. And, after all, how many characters are really used in distinguishing one species from another? A detailed description is of course a necessity but to the mind of the inexperienced it furnishes no distinct picture of the object and consequently a few words to focus his attention upon the most important features are of great assistance.

No one can use the book without experiencing the hope that the authors may put forth a companion work upon the North American shrubs. The need of such a book is constantly brought to the attention of the reader because the authors are often obliged to consider forms that are popularly looked upon as belonging to that imaginary group called shrubs — indeed it is not clear why several forms have been apparently discriminated against and excluded from a place in the book, especially some of the species occurring in the alder, wax-myrtle, cornel, elderberry, and viburnum genera. Probably because it is impossible to draw the line between trees and shrubs. Abridged, pocket editions of these books, somewhat after the plan of the little German guide-books, would meet a long felt want and would be immensely popular. Complaints are often heard of the lack of interest in botany in the United States, but we never stop to consider how little has been done for those who are not somewhat familiar with the subject. The great majority of the books upon botany are of no service to the untrained and this applies to many of the so-called popular works, owing to their fragmentary

and empirical character. A series of small books upon the trees, shrubs, and herbaceous plants, and upon the ferns, mosses, hepatics, fungi, lichens, etc., would be of the greatest service in arousing interest in botany and do more to further its advancement, we believe, than is being accomplished to-day by the schools and numerous publications.

The number of tropical and subtropical trees occurring within the range covered by the book is remarkable. These forms are becoming somewhat familiar to us through their cultivation in greenhouses and their utilization in other ways; and it is indeed a great service to make their identification and interesting features readily accessible. Several desirable changes have been made in the scientific and common names; mention may be made by way of illustration of the substitution of *Magnolia grandiflora* for *M. foetida* and of the separation of the flowering dogwoods, under the generic name, *Cynoxylon*, from the cornels. Whatever may be the laws governing such matters it will be a satisfaction to use an appropriate name for the attractive and fragrant great laurel magnolia and to give generic rank to so distinctive forms as our dogwoods.

The book is provided with a complete index and glossary, and an excellent series of keys, running the forms out to families, genera, and species. These features are of great service and will widely extend its usefulness and make it indispensable as a work of reference.

CARLTON C. CURTIS.

COLUMBIA UNIVERSITY.

PROCEEDINGS OF THE CLUB

APRIL 29, 1908

The meeting was called to order at 3:45 P. M. by Vice-president John Hendley Barnhart. Fourteen persons were present.

The following abstracts were submitted by the authors of the papers presented:

"The Boleti of the Frost Herbarium," by Dr. William Alphonso Murrill.

This paper will shortly be published in full in one of the periodicals of the Club.

"Suggestions for Future Work on the Flowering Plants of the Local Flora," by Dr. Roland M. Harper, chairman of the Phanerogamic Division of the Committee on the Local Flora.*

"Exhibition of Specimens Recently Collected in Jamaica, with Remarks," by Dr. N. L. Britton.

A specimen was exhibited of the nest of the Jamaica swift made from the downy seeds of species of *Tillandsia*, and presented to the New York Botanical Garden by F. B. Sturridge, Esq., of Union Hill, Moneague, Jamaica.

Fruits were also shown of the Jamaican species of *Hernandia*, preserved in formalin, together with herbarium specimens from the same tree, found by Mr. William Harris and myself on the wooded hill near Dolphin Head, a mountain near the western end of Jamaica, and collected March 21, 1908. This tree is one of the largest of the Jamaican forests and apparently either very rare or very local in its distribution. It attains a height of at least 30 meters and a trunk diameter of over a meter. It has not been very definitely known to botanists, inasmuch as Patrick Browne in the "Civil and Natural History of Jamaica," published in 1756, knew of its occurrence there only by rumor, and it is not recorded for Jamaica by Grisebach in the "Flora of the British West Indian Islands." In the treatment of the genus in De Candolle's "Prodromus," Meissner attributes it to Jamaica on the authority of Patrick Browne, but Mr. Harris, in his extensive exploration of the forests of the island, had not been able to find much of it until this discovery near Dolphin Head, where a tree some 20 meters high was cut down and fine fruiting specimens obtained. An examination of these specimens in comparison with those of the other species indicates that the Jamaican tree differs from those of the other West Indies and of the East Indies, and should be defined as a species new to science.

C. Stuart Gager,
Secretary.

* Editor's Note.—This paper is published in full in the present issue and the abstract is therefore omitted.

MAY 27, 1908

The Club was called to order at the Museum Building of the New York Botanical Garden at 4 P. M. by Vice-President John Hendley Barnhart. Eight persons were present. After the reading and approval of the minutes for May 12, 1908, the announced scientific program was presented. The following abstracts were prepared by the authors of the papers:

"The North American Species of *Zygodon*," by Mrs. N. L. Britton.

Attention was called to the fact that *Zygodon viridissimus* is a rare species, having been found only a few times in the high mountains of the southern Alleghanies and northern New York. It is usually sterile and propagates by septate brood-bodies, borne in clusters in the axils of the leaves. Fruiting specimens, collected by Dr. J. K. Small on the summit of White Top, Virginia, showed that the peristome is absent, though all the capsules found were either too young or too old for satisfactory determination. A comparison with specimens collected by Drummond near Hudson Bay show that the latter belong to *Zygodon rupestris* which is variously placed by European authors, either as a species or a variety of *Z. viridissimus*. Sterile specimens of *Zygodon gracilis* have been recently discovered in North Carolina by Dr. A. J. Grout. *Zygodon excelsus*, whose fruit is also still unknown, appears to be more closely related to *Leptodontium* than to *Zygodon*.

"The Acceleration of Senescence by Radium-Rays," by C. Stuart Gager.

In view of the fact already well known, that, as old age approaches, the size of the cell-nucleus, becomes less relative to that of the cell, measurements were made to see if this relation was affected by exposure to radium rays. It was found that in cells near the root-tip of *Zea mays* the diameter of the nucleus was 35.5 per cent. that of the cells, in unexposed plants, but only 33.33 per cent. in roots exposed to radium rays. This is some evidence that exposure to radium rays accelerates the approach of the period of senesence.

"A Collection of Philippine Fungi," by W. A. Murrill.

A splendid collection of fungi, six hundred and thirty-seven packets in all, were recently received from the Bureau of Science, Manila, through Mr. E. D. Merrill, Botanist. Previous work upon the fungi of this region was briefly sketched, and the collections of Philippine fungi in various institutions compared.

This paper will be published in full, with notes and descriptions of interesting species, in a future number of the *Bulletin* of the Torrey Botanical Club.

An announced paper on "Botanical Supplies in the Public Schools," was not given on account of Dr. Hollick's unavoidable absence.

At the close of the stated program, Dr. Gager exhibited some photographs of flowers, etc. taken in natural color at the New York Botanical Garden by the Lumière process. The process was briefly explained.

Dr. Murrill exhibited a specimen of "Tuckahoe," and called attention to the fact that the sporophore of a *Polyporus* had been obtained from a form common in parts of Canada, the "Tuckahoe" being a sclerotium, or a resting stage of the mycelium in mass. He would be glad to receive specimens of these sclerotia, either fresh or dried, from any locality, so that the various species, if more than one exists in this country, may be properly distinguished.

Dr. Barnhart exhibited for Mr. Nash a flowering specimen of the lace-bark tree, *Lagetta Lintearia*, a native of the West Indies. This tree is known to have flowered only once before in cultivation. An article on the specimen, and the peculiarities and uses of the lace-like bark will appear in the June, 1908, number of the Journal of the New York Botanical Garden.

Adjournment was at 4:50 o'clock.

C. STUART GAGER,
Secretary.

OF INTEREST TO TEACHERS

BIOLOGY IN HIGH SCHOOLS*

BY JULIUS NELSON

The word "biology" is here used to include botany, zoölogy, and physiology, under one term. These three sciences are closely interrelated: it is recognized that zoölogy and physiology are best taught together; so also it may be noted that the course called "general biology" embraces an alternate comparison between vegetable and animal forms. Zoölogy and botany may advantageously be studied thus intermixed, because, first, the chemical and physical forces are common to all the kingdoms of nature; second, because of the ecological interactions between the two organic kingdoms as illustrated by parasitism, symbiosis, fertilization of flowers by insects, food relations, etc.; thirdly, seasonal changes affect both plant and animal life, calling for a study of both kingdoms throughout the year.

On the other hand, from the systematic point of view, it is as convenient to take botany and zoölogy separately and successively, as it is to consider the classes of animals in definite order. There are other reasons in favor of studying a particular branch of biology during a definite period.

There should be no question as to the propriety of including biology in the high school curriculum. As one at least of the three branches of biology has been taught in a large proportion of the high schools for an indefinite period of years, we should not be charged with trying to crowd a "new fangled fad" into an already overcrowded curriculum.

So far as biology replaces physiology, botany, and zoölogy and is given only the time of a single study, the result may be to reduce the time given to biological study, a reduction to be deplored, for never even under the most favorable circumstances, have these subjects been granted their due proportion of time in comparison with other subjects. The three R's are taught *daily* from the kindergarten to the college sophomore year, yet the fear is often expressed that the fundamentals of education are endangered

* An address delivered before the New Jersey Science Teachers Association at Newark, New Jersey, May 23, 1908.

by the encroachments of such hobbies of the faddists as "nature-study," "agriculture," "biology," and an indefinite number of other "ologies." So far as this fear is well founded the attempt to replace three of the "ologies" by a single one, should be welcomed. Yet this does not seem to meet the pedagogic ideals of educators on the one hand, nor of business men on the other. These are gravely asking what benefit comes from a study of natural science? Does it induce to efficiency? Does it confer mental training and power? Does it equip the student with the tools whereby he can win success in business competition? And if natural science be admitted into the general curriculum, why *biology*, rather than physics or chemistry? Is not biology a technical subject fit only for those who are to enter the medical profession? Do not physics and chemistry underlie biology whereas no knowledge of biology is needed for the study of the physical sciences?

It is not my purpose to answer these questions, they have been ably answered by others, such as Lloyd, Bigelow, and Hodge. We are convinced that biology should form an essential part of a common school education and we call attention to tendencies operating against this.

College entrance requirements determine to a large degree the contents of the high school curriculum. But the college has practically abandoned the old time "general course" which included a considerable list of the natural sciences. The present ideal is the "technical" course, fitting the graduate for a particular business, and including only the studies that most directly bear on the aim of the course. Biology is retained practically only in the courses leading to medicine or to agriculture. Physics and chemistry underlie most technical courses, therefore the college requires the physical rather than the biological sciences as preparatory for entrance. In regard to the classical and literary courses, the so-called "culture" courses, the case is no better, for in these, the "sciences" are offered as "electives" that may or may not be chosen. The classical courses are in fact as highly technical as any course by specializing in language-training, so useful to preachers and lawyers. Conditions that

favor the special course, operate also in the high school. There are the "classical" and the "scientific" courses, preparatory for college. As the majority of its graduates do not enter college, it is urged that such should not be compelled to take these preparatory courses, but for them should be provided suitable courses fitting for business, teaching, etc.; the ideal is the *special*, rather than the *general* course. In a normal course some biological study has generally been included, not as an essential educational element, but because the teacher anticipates the possibility that he may be required to teach the subject. In the training of teachers for special lines, biology is naturally excluded; and unless biology be established as an essential part of secondary education, there will be a decreasing number of general teachers prepared to teach this subject. Perhaps most of the educated men of yesterday had studied some biology though but a mere smattering of antiquated rudiments; to-day, very few of our educated men have received even that much. This is the more remarkable in view of the recent wonderful development of this science, and the increasing rate at which biological problems are pressing into public interest in directions both practical and theoretical. The air is full of biologic lore though mostly false, inadequate, and distorted. Our newspapers have it in the editorial, in the advertizing, and the reportorial column. A biological basis underlies half the utterances of the pulpit. Questions of public policy involving ventilation, disinfection, quarantine, pure food, alcohol, athletics, protection of birds, and of forests, destruction of insects, eradication of tuberculosis, etc. envelope us as an atmosphere; yet the principles involved, are considered expert knowledge, just as in olden days the average man had to hire his reading and writing done for him.

If any one doubts the statement that our educational ideals are against including biology as an essential of a general education, let him try to have biology substituted for even so small a part as one tenth of the time devoted to Mathematics, English, Greek, Latin, or German, in our educational institutions. The time given to the so-called "humanities," has been increased by borrowing from scientific subjects, and often actually excluding biology.

While this retrograde movement has progressed in the higher education, a counter movement has arisen for the introduction of "nature study" into the earlier years of the common schools. Biology necessarily is the principal content of Nature Study. If such study does not interfere with the preparation to meet the requirements for promotion to higher grades, there is hope for the success of the movement, and so in time, everybody will be given a kindergarten knowledge of biology. But is this amount of knowledge sufficient for a full and perfect living?

It is a trite saying that education has a two-fold aim, viz.: the training of faculties, and the acquisition of truth. We have other faculties than those involved in the three R's; and there is truth outside the so-called "humanities." The objective world of nature incarnates at least one half of truth.

Nature is not a disagreeable prison house to be shunned but it is the handiwork of the Almighty — the macrocosm out of which Man the microcosm has been evolved, to reflect the image of God. The natural sciences may properly be contrasted with the "humanities" by being called the "divinities"; a man has only a one-sided education who has not studied both.

Such a symmetrical education should be provided as a "general course" lying as a foundation for all special courses. Such a course has been crowded out of the college; it must find place in the high school, where it should be nourished and defended, as the fruiting of the common course of the lower grades. The high school is the *people's college.* We should substitute for the old three-legged-stool ideal of education, called the three R's a broad, up-to-date, common, intellectual bond for all mankind. Such a course should consist of equal proportions of six subjects; and the school day should be divided into six equal periods to accommodate them: viz., language, mathematics, manual training, history, geography, and art training (or ethics). Political geography is best studied with history; but geography as "the description of the world" means nature study, or the natural sciences.

Nature always presents itself as a complex unit to be analyzed, and therefore the earlier study of nature should be general and

superficial; the study of special branches of science begins with the first year of the high school, when physical geography or physiography may be begun, and in the spring the attention may be given to the unfolding vegetation. Next autumn the plant and insect world can be considered in their interrelations. When the leaves fall, comparative anatomy and general physiology, that is, "zoölogy" may be studied, taking up the development of the hen's egg in the spring and making comparison with the developing eggs of the frog and of insects. The third year may be devoted to physics and the fourth to chemistry; but these sciences have their highest applications in physiology, and the best reason that can be given for their study is that they make it possible for us to understand physiology. Hence I would combine physiology with them. Yet so interrelated are all departments of knowledge that it becomes easy and proper to include natural science in general and biology in particular in much of the work of the other hours of the school day. Under history will be included the biographies of the scientists and the history of science, as well as much of anthropology. Under language will come not only readings in scientific English but also in scientific German. Under art will be included drawings of living models. Under manual training will be included not only writing but school gardening and practical agriculture, also wood working, etc. Even mathematics should be extended to the solution of problems in physics, chemistry, biology, physiology, etc. In this way the student realizes that knowledge is compactly knit together, as an organized unity. And this is the most cogent reason why all men should have a general training. Special training can be offered in various directions, not by exclusion of any one of the six fundamentals, but by varying the proportion between the branches that belong in each. Thus in a classical course, the language hour can be devoted to Greek or Latin rather than to French or German. In the business course, the mathematical hour can be devoted to business arithmetic. In a similar way we can have as many special courses as we desire without narrowing the foundation.

RUTGERS COLLEGE.

The *Bulletin* of the Torrey Botanical Club for May, contained an article by Professor John W. Harshberger on the water-storing tubers found on *Asparagus Sprengeri*, and on two species of ferns, *Nephrolepis cordifolia* and *N. davallioides*. Fresh tubers were tested microchemically for various food substances; the results indicated that water storage is their principal function.

In this period of too rapid utilization of our forest products it is a relief to hear from the Forest Service that "on the Pacific coast, especially in Oregon and California, there is an immense amount of white fir (*Abies concolor*) timber now going to waste for lack of some commercially profitable means of disposing of it. At present it is very little used for lumber, and since it is not cut to any extent its proportion in the forest tends to increase at the expense of other and more valuable trees. Experiments conducted at the Forest Service laboratory at Washington show that this wood is admirably adapted for the production of paper pulp by the sulphite process. It is also claimed that, so far as the product is concerned, the manufacture of fiber from white fir would be a commercial success and that the fiber produced would find its greatest usefulness in the production of manilas, where great strength is required, and in tissues which need very long fibers. It seems probable, also, that it would make very good newspapers, for which purpose its naturally light color would particularly adapt it.

NEWS ITEMS

Mr. David Day Whitney has been appointed instructor in biology at Wesleyan University.

Mr. Harry L. Wieman has been made instructor in biology at the University of Cincinnati.

Professor Frank Lewis Rainey, of Parsons College, Iowa, has been appointed as professor of biology in Central University, Kentucky.

Edward W. Berry, of the Johns Hopkins University, has been appointed American editor for Paleobotany on the Botanisches Centralblatt.

Mr. William Bateson, F.R.S., who recently lectured on heredity in this country, has been elected to the chair of biology at Cambridge University.

At Western Reserve University, Mr. Carl Byron James has been made assistant professor of biology in Adelbert College and the College for Women.

Mr. Martin J. Iorns, horticulturist at the Experiment Station, Mayaguez, P. R., has gone to Cuba and Florida to investigate the citrus and pineapple industries.

Dr. Henrietta E. Hooker has resigned her position as head of the department of botany, having been thirty-five years in the service of the college. She will be succeeded by Associate Professor Mary E. Kennedy.

Mr. L. W. Hawley, expert on wood distillation for the Forest Service, has left Washington for Oregon, Washington, Montana, and Idaho, to investigate the possibilities of a future turpentine industry in the northwestern portion of the United States.

The Sheffield Scientific School of Yale University has purchased a site at the end of Rocky Beach off Bradley Point, Savin Rock, on which an experiment and collecting station will be erected. The building is intended for use during the college year when the Marine Biological Laboratory at Woods Hole is not accessible.

King Victor Emmanuel, of Italy, has erected a palace for the International Institute of Agriculture. Mr. David Lubin, of San Francisco, was the originator of the idea and a prominent delegate at the dedication. Although the many proposed activities of the Institute are chiefly social and economic, they are to be based upon strictly scientific investigation, and the reports, such as warnings of the appearance of new plant and animal diseases, will be of distinct value to science.

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A STUDY OF THE DIGESTIVE POWER OF SARRACENIA PURPUREA

BY WINIFRED J. ROBINSON

INTRODUCTION

The family Sarraceniaceae consists of three genera, two of which are each represented by a single species, *Heliamphora*, collected in Guiana by Schomburgk and Im Thurm, and *Darlingtonia*, which grows in the mountains of California, while *Sarracenia* has seven species described for eastern North America (Macfarlane, in Engler, Pflanzenreich (Heft 34) **4**^{110}: 24. 1908). Natural hybrids have been observed by Harper (Bull. Torrey Club **30**: 332. 1903; **33**: 236. 1906) and Macfarlane (*l. c.* 21) and numerous artificial hybrids have been produced by horticulturalists. All members of the family are native to sunny bogs where their pitchered leaves appear in rosettes from the center of which the flowers arise.

The leaves of *Sarracenia purpurea* are trumpet-shaped with a ventral wing and a terminal lid or lamina (FIG. 1*a*). The outer surface has short, blunt, upwardly directed hairs, cells with the wavy outline of ordinary epidermal cells, and numerous stomata. The inner surface of the terminal portion, or lamina, the "attractive surface" according to Hooker (Nature **10**: 369. 1874) is covered with stiff, reflexed, whitish hairs, the surface of which is corrugated. These contained, in the specimens examined by the writer, a colorless or pinkish fluid with vacuoles, though Vogt (Sitzungsb. Akad. Wiss. Wien **50**: 281. 1864) stated that he found no solid or liquid contents in them but that they were filled with air, and Wunschmann (E. & P. Nat. Pflanzenfam. **3**^{2}: 352. 1891) speaks of them as filled with air. At the entrance to the

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pitcher cavity the hairs cease and a smooth area succeeds, due to the somewhat papillate form of the epidermal cells, which was termed by Hooker the "conducting zone" (FIG. 1*b*). The walls are strongly cuticularized, especially in the rolling margin between the inner and outer surfaces of the pitcher. Below this is a glabrous area, the "glandular zone" (FIG. 1*c*), and at the base of the pitcher is a region which bears long needle-like hairs, the "detentive surface" (FIG. 1*d*). Each of these areas bears glands except the last. Hooker (*l. c.*) stated that there were no honey-glands in *Sarracenia purpurea*, but Schimper (Bot. Zeit. **40**: 227. 1882) thought from the structure of crystals in the upper part of the leaves which he had dried, as well as from the behavior of insects, that nectar glands occurred in the upper part of the pitcher. Goebel (Pflanzenbiol. Schild. **2**: 90. 1891) also described nectar glands in this area. The discrepancy between these two statements may be explained by the theory which Hooker (*l. c.*) has advanced for other species, that "the saccharine fluid only makes its appearance during one particular period in the life of the pitcher." Macfarlane (Ann. Bot. **7**: 407. 1893) says that the protective winter bud-leaves show many honey-glands particularly on the outer surface.

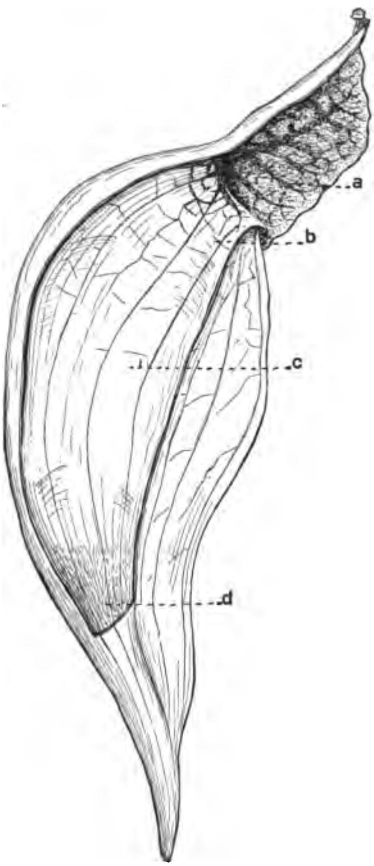

FIG. 1. Leaf of *Sarracenia purpurea* with a portion of the pitcher cut away to show the areas described by Hooker as (*a*) the "attractive surface," (*b*) "conducting zone," (*c*) "glandular -zone," and (*d*) "detentive surface."

St. Hilaire (Morphol. Vég. 142. 1840) and Duchartre (Élém. Bot. 308. 1867) regarded the leaf as a pitchered petiole with a lid which represents the true leaf. Baillon (Compt. Rend. **71**: 639. 1870) compared it to a peltate Nelumbian leaf and interpreted the lower part as the petiole, the pitcher with its wing as corresponding to a ridge on the outer base of peltate leaves of certain Nymphaeaceae, while the lid represents a terminal lobe. Asa Gray described the pitcher as a phyllodium, the terminal lid as the blade of the leaf. Macfarlane (Ann. Bot. **3**: 264. 1889) describes it as the hollowed-out upper part of the midrib "in front of which two elongated green leaflets have fused, producing a prominent wing, a dorsal continuation of the pitchered midrib in flattened form which gives off on either side two leaflets, the whole constituting the lid." He bases this theory largely upon the arrangement of the vascular bundles, which are in two parallel rows with their xylem portions facing each other. Goebel (*l. c.* **2**: 76. 1891) criticizes this view, saying that the primordium of the leaf resembles that of bud-scales with no differentiation into petiole and blade. He regards the lid and pitcher both as parts of the structure termed lamina in the ordinary type of leaf. Bower (Ann. Bot. **4**: 167. 1889) has reviewed the theories of Macfarlane and Goebel and concluded that "the leaf of *Sarracenia* is a simple phyllopodium, consisting of (1) a basal sheathing portion, (2) a middle portion which may be hollowed by involution of the upper surface, and bear upon its upper surface a phyllodineous flap, and (3) the lid which is the simple, flattened termination of the leaf."

The leaves of seedlings, with the exception of the cotyledons, develop as pitchers in all the species that have been examined. Shreve (Bot. Gaz. **42**: 118. 1906) describes the development of seedling leaves of *S. purpurea* as follows: "The first epicotyledonary leaf arises opposite the interval between the cotyledons. It is finger-shaped with a somewhat broadened base. On reaching a length about twice its diameter there begins a rapid lateral outgrowth of the tissue of an O-shaped area on the side of the leaf rudiment which faces the growing point, giving rise to a pit which is destined to become the cavity of the pitchered leaf.

The basal part of the O-shaped outgrowth now begins to grow upward, in which it is accompanied at the same rate by the upper portion of the O, which at the same time carries forward the apical growth of the leaf. The cavity of the pitcher thus grows in depth by the upward growth of the tissue by which it is surrounded. The bottom of the cavity is subsequently elevated by the further growth of the tissue beneath it."

Plants of *S. purpurea* kept under glass for a year at the New York Botanical Garden showed a marked tendency to form blade-like structures instead of ascidial leaves. Goebel (*l. c.* 73) describes in several species this tendency to produce leaves without pitchers at the close of the vegetative period.

The peculiar form of the leaves of *Sarracenia* has attracted the attention of the curious ever since their discovery. A specimen of *S. flava* brought to France by a sailor with the legend that it grew on a fragrant Canadian tree was named leaf of the incense tree (*Thuris Limpidi folium*) and figured by de L'Obel (Adversaria 430. 1570). *S. purpurea* was figured and described by Clusius (Hist. Rar. Pl. 4 : 82. 1601) as a plant whose leaves were like the flowers of Aristolochia. He named it *Limonium peregrinum* from its fancied resemblance to sea-lavender (*Limonium carolinianum*). John Josselyn in "New England's Rarities," 1672, describes it as follows: [John Josselyn, New Eng. Rar. (ed. Tuckerman)—(95). 1865] *Hollow Leaved Lavender* is a Plant that grows in salt Marshes overgrown with Moss, with one straight stalk about the bigness of an Oat straw, better than a Cubit high, upon the top standeth one fantastical Flower, the Leaves grow close from the roots, in shape like a Tankard, hollow, tough, and always full of Water; the root is made up of many strings, growing only in the Moss, and not in the Earth, the whole Plant comes to perfection in *August* when it has Leaves, Stalks, and Flowers as red as blood, except the Flower which hath some yellow admixt."

The Indians of southern Minnesota called it ko-ko-moccasin, or owl's moccasin. From the rhizome and young leaves a concoction was made by the Canadian Indians which they believed to be a remedy for small-pox (Millspaugh, Am. Med. Pl. 19–3. 1887). This has been used to a certain extent in homeopathic pharmacy.

Linnaeus (Sp. Pl. 2d. ed. 728. 1763) adopted the name *Sarracenia* given by Tournefort (Inst. 1 : 657. 1700) in honor of Dr. Sarracin, a physician of Quebec, who sent to France the specimen described by him.

The use of the pitchers to the plant has been variously explained. Catesby (Nat. Hist. Car. 2 : 70. 1754) described them as asylums providentially provided for insects, so that they might escape from the frogs which pursue them, but most writers have thought that the advantage was on the side of the plant rather than that of the insect. Linnaeus (Sys. Veg. 491. 1784) described the evolution of the pitchered leaf and its value to the plant thus : "Sic metamorphosis folii Nymphaeae in folium Sarraceniae, ut ipsa aquam pluvialem excipiens et retinens extra aquas crescat; mira naturae providentia !"

Wheeler (Bull. Am. Mus. Nat. Hist. 22 :415. 1906) records the use of pitchers of *Sarracenia* as nesting places for two species of ants (*Dolichoderus Mariae* and *Tapinoma sessile*), which had not apparently suffered from their surroundings. In the same article he speaks of finding nests of a bog-loving species (*Cremogaster lineolata pilosa*) in old pitchers, the proximity of which to the functional, water-containing pitchers had caused many of the workers to drown in their ascidia. Certain carrion flies are reported to lay their eggs in the debris in the bottom of the pitchers, and the larva of one kind of mosquito is said to develop in them, living in them through the winter.

The color of the old pitchers is usually a dark purplish red, but the young pitchers are light green with a network of red veins if they grow in the open, while shade makes them develop a uniform deep green. This is illustrated in the swamps along the railroad near Lakewood, N. J., where the red of the pitchers in the clearing contrasts with the green of those growing under the cedars (*Juniperus virginiana*). Gies (Jour. N. Y. Bot. Garden 4 : 37. 1903) states that the dilute neutral extract of the leaves of *S. purpurea* is practically colorless, an acid extract is crimson, and an alkaline solution, green. He has given the name alkaverdin to the pigment because of the beautiful green color produced by the addition of an alkali. It has a superficial re-

semblance to the coloring matter of the elderberry and red cabbage, but is unlike them in fundamental chemical characters. The aqueous extract is dextrorotary, reducing, and fermentable. Husemann (Pflanzenstoffe 107. 1871) describes an alkaloid called sarracin in the form of needle-like crystals which can be isolated from the rootstock.

Schimper, in 1882 (Bot. Zeit. **40**: 226. 1882) made digestion experiments upon plants of *S. purpurea* which were growing wild in the Massachusetts bogs. Some of his observations were made upon insects caught by the plants, and some upon pieces of meat that had been placed upon the leaves. He found that on closing the pitcher with tissue paper at the time of opening and thus preventing the free entrance of bacteria the digestion took place no more quickly than in water outside the plant.

Goebel's (*l. c.* 167) experiments were conducted upon plants under cultivation. The pitchers were filled to within 10 cm. of the top, and closed with a cork covered with paraffin. The height of the fluid was measured by a strip of paper fastened on the outside of the pitcher. After 48 hours the following observations were made: The fluid in the pitcher containing 1.0 per cent. formic acid in which fibrin previously swollen had been placed, was lowered 6.8 cm.; the remaining liquid was acid, the fibrin was not attacked. Water in another pitcher was reduced from 10 cm. to 8 cm. by absorption. Meat-extract neutralized with sodium hydroxide was reduced from 10 cm. to 7.5 cm. The meat-extract was full of bacteria, turbid, and alkaline in reaction. A piece of meat the size of a pea was placed with water to a height of 10 cm. in a young green pitcher. After 2 days the column was reduced to 8.2 cm., but the meat had scarcely changed though it was covered with bacteria. A small piece of meat was placed in another young pitcher with meat-extract. After 3 days the meat had a bad odor, but not as unpleasant as that of the control, and it eliminated ammonia.

From the results of these experiments Goebel concluded that *Sarracenia* had no protein dissolving enzyme or antiseptic substance and that the inner surface of the pitcher, especially the lower part, could absorb water and dissolved substances.

Experiments

The present series of experiments was undertaken under the direction of Professor William J. Gies, at the New York Botanical Garden, in the summer and autumn of 1907, in order to determine especially the digestive power of *Sarracenia purpurea* on carbohydrates, fats, and proteins.

The plants were obtained from the sphagnum bogs near Lakewood, N. J., and from a similar locality near Poughkeepsie, N. Y. No difference was observed in the behavior of the plants from the two localities. They were planted in sphagnum and kept in the propagating houses of the New York Botanical Garden under as nearly natural conditions of temperature and moisture as possible. Before a solution was placed in a pitcher the contents were withdrawn by means of a pipette, the pitcher was thoroughly, though gently rinsed with tap-water and distilled water, and swabbed with absorbent cotton. After the solution had been placed in the pitcher, it was covered with lace net which proved effectual in preventing the entrance of insects except during the use of olive oil, which was so attractive to ants that it was necessary to set the crocks containing the plants used for those experiments in dishes containing water to keep the ants out. The materials used in the protein tests were prepared under Professor Gies's personal supervision and great care was taken in handling the others.

Tests were made of the effects of various solutions with the special purpose of providing helpful information for use in the subsequent digestive work.

I. Effects of Various Solutions

Acetic Acid.—A 0.5 per cent. solution of acetic acid was found to be injurious. Pitchers containing it began to wither above the level of the liquid within a few hours, and were dead at the end of six days.

Potassium Nitrate.—A dilute solution of potassium nitrate ($m/1024$) proved harmless, though by frequent renewals it was kept in the pitchers a period of six weeks. A 0.5 per cent. solution of potassium nitrate was not injurious. In one case per-

ceptible growth occurred in its presence, but a 1 per cent. solution caused pitchers to wither in six days, while a 2 per cent. solution made them brown and dry in three days. Both young and matured pitchers were used for this experiment but the results were the same in either case.

Sachs's Nutrient Solution. — A nutrient solution such as that commonly used as a water culture for flowering plants (per 6,000 c.c.: $CaNO_3$, 6.0 gr.; KNO_3, 1.5 gr.; K_2HPO_4, 1.5 gr.; $MgSO_4$, 1.5 gr.; $FeSO_4$, a trace) was placed in pitchers, and caused them to begin to decay within a few days, the tissues being entirely dead in from two to three weeks.

Liebig's Meat Extract. — The effect of a stimulant was tested by means of a dilute solution of Liebig's meat extract. Bacteria and infusoria developed in great numbers, however, and the pitcher began to wither in less than a week, becoming entirely decayed in about two weeks.

Milk. — A solution of milk, one drop in 10 c.c. of distilled water, which was neutral to litmus when placed in the pitcher, gave no odor and no acid reaction with litmus at the end of six days. When the concentration was doubled the solution became acid and the pitcher decayed almost completely in two weeks. A solution of milk, 20 per cent. by volume in distilled water, coagulated and became unpleasant in odor, within two days. It was inferred that the pitcher gave out an alkaline substance which reacted with the acid produced in the very dilute solution of milk but was not sufficient to neutralize the solutions of greater strength. There was nothing to indicate that the milk fat or protein was digested.

Distilled Water. — For comparison with the preceding solutions, distilled water was kept in certain pitchers for a period of about five weeks, by means of frequent renewals. There was no change in the external appearance of the pitchers, which is interesting from the fact that a concentrated solution of sucrose was equally harmless, so that the tissue of the pitcher is able to adapt itself to solutions widely different in osmotic strength.

The following solutions were also placed in the pitchers of *Nepenthes distillatoria*, the plants being kept in the propagating

houses of the New York Botanical Garden under the same conditions as those of the plants of *Sarracenia*.

Potassium Nitrate.— A dilute solution of potassium nitrate ($m/1024$) proved harmless at the end of nine days as far as could be determined from external appearances, but after twelve days the pitcher began to wither.

Sachs's Nutrient Solution. — *Nepenthes* pitchers were somewhat more resistant to the nutrient solution than those of *Sarracenia*, as the withering of tissues was not apparent until about eight days had elapsed from the time the solution was put into the pitchers.

Liebig's Meat Extract. — *Nepenthes* pitchers proved more resistant to the dilute solution of Liebig's meat extract than *Sarracenia*, as the pitcher contents did not seem foul and the pitchers did not decay during the two weeks which the solution was allowed to remain in them. This may have been due to the digestion of the bacteria by infusoria, which were present in large numbers. Of course it is possible that bacteria were digested by the proteolytic enzyme, nepenthin.

II. Effects on Carbohydrates

Glucose. — A 10 per cent. solution of glucose was placed in pitchers of *Sarracenia* and allowed to remain from four days to three weeks. With Fehling solution they gave the reddish brown coloration promptly in every case, on heating, which indicates that at least some of the glucose remained, although no tests were made to determine the absence of reducing substances that might have been produced from the glucose. The quantity of the latter was naturally diminished by ordinary fermentation. There were no indications of a detrimental influence exerted by any of the fermentation products. The α-naphthol test indicated in each case the presence of much carbohydrate.

Sucrose. — Solutions of cane sugar (sucrose, c.p.) of a very low degree of concentration (less than 1 per cent.) were introduced into the pitchers of *Sarracenia*.

There was no apparent bad effect. Further trials with stronger solutions were made until it was found that a solution of 33 ⅓

per cent. could be resisted for two months, with no apparent injury to the pitcher. The growth of the young pitchers containing such a solution was equal, so far as it could be measured, to that of pitchers containing water. Solutions of the various strengths were tested with hot Fehling solution after they had been in the pitchers from three to seven days. The contents of each pitcher gave a reddish precipitate of copper oxide, indicating the production of invert sugar. A heavy reduction of Fehling solution also occurred spontaneously without heating although water from the pitchers did not behave in this way.

As checks for this experiment, Fehling solution, as well as Fehling solution with an equal quantity of the stock sugar solution was boiled, but neither gave an indication of reduction.

Starch. — Starch paste was placed in the pitchers and allowed to remain three or four days, in one case as long as thirteen days, when it was removed and tested in the usual way with Fehling solution. The result indicated that a reducing compound, presumably sugar, had been formed, the exact nature of which was not determined however. When Fehling solution was added to starch paste from the pitchers *without boiling*, no reduction occurred, so that the reducing power of the contents was not so marked as in the case of the cane sugar. Tested with iodine, a few blue granules indicated that not all the starch had been hydrated. Toluol sufficient to form a thin film over the top of the fluid in the pitcher was added in some cases but the reduction was the same as in the case of pitchers to which no antiseptic had been added. From this it may be concluded that the change from starch to reducing substance (sugar ?) is due to an enzyme secreted by the cells of the pitcher. There were no indications of fermentation in the pitchers with toluolized contents.

As checks in the experiments on the action of the pitchers upon starch paste, Fehling solution was tested by boiling; tap-water and Fehling solution were boiled together; and tap-water which had been in the pitchers for the same length of time and under the same conditions as the starch paste, was boiled with Fehling solution; also, tap-water to which toluol had been added, and which had been allowed to stand in the pitchers the same

length of time. Samples of the fresh starch paste and of that which had been allowed to stand in a flask near the pitchers, with and without the addition of toluol, were boiled with Fehling solution. In no case was there any reduction, hence the reduction which occurred with the liquid from the pitchers cannot be attributed to impurities in the fluids used in the experiments.

The above carbohydrates were also introduced into the pitchers of *Nepenthes*, with the following results :

A solution of glucose of the same concentration as that used in the pitchers of *Sarracenia* was placed in the pitchers of *Nepenthes* and allowed to remain four days with apparently no harmful effects. The test with Fehling solution resulted positively.

A 10 per cent. solution of cane sugar which had been allowed to stand in the pitchers of *Nepenthes* four days was tested with Fehling solution but failed to manifest reducing power, hence it was inferred that no cane sugar reducing enzyme was present in the contents of the pitchers in this experiment. Probably no such enzyme is normally produced by *Nepenthes*.

Thin starch paste was placed in the pitchers of *Nepenthes* and tested after four days with Fehling solution, but no reduction occurred, which indicates that *Nepenthes* does not give out such a starch splitting enzyme as that secreted by *Sarracenia*. The iodine test showed that the starch granules in the paste had not been broken down.

As these experiments were conducted at the same time as those upon *Sarracenia*, the same checks applied to both, making the results all the more significant.

III. Effects on Fats

Olive Oil.—As a test of the fat-digesting power of *Sarracenia*, washed neutral olive oil, in the proportion of 0.4 c.c. of oil to 9.6 c.c. of distilled water or tap-water was used. The mixture was well shaken immediately before it was introduced into the pitchers. After the mixture had been in the pitcher from four to seven days it was removed and titration was effected by means of phenolphthalein as the indicator, the number of drops of *m*/100 potassium hydroxid solution needed to neutralize a uniform quan-

tity of the fluid being taken as a measure of the lipolytic power of the liquid. The amount of alkali required (except in certain abnormal cases, which were caused by the accidental presence of ants in large numbers and consequent putrefactive lipolysis) was the same as for an identical volume of the liquid which had not been introduced into the pitchers, so it may be inferred that no digestion of the fat occurred.

As a check, a mixture of olive oil and water of the same proportion as that used in the preceding experiments, with the addition of toluol was placed in several pitchers but the amount of alkali necessary to neutralize was so nearly the same in every instance as to indicate that the oil was neutral and that no digestion occurred.

Ethyl Butyrate. — As a further test of the fat digesting power of *Sarracenia*, tap-water which had been left in the pitchers one day was removed and placed in stoppered bottles with ethyl butyrate in the proportion of four drops of the butyrate to 2 c.c. of the pitcher liquid. It was allowed to remain at room temperature twenty-four hours and then titrated, phenolphthalein being used as the indicator and the lipolytic activity of the fluid being measured by the number of drops of *m*/100 sodium hydroxide solution needed to neutralize it. In place of tap-water, a very dilute solution of potassium hydroxide (KOH *m*/100), and also a very dilute solution of acetic acid (KOH *m*/100), was used in testing the contents of certain pitchers, but the number of drops of the alkaline solution needed for neutralization did not indicate any digestion.

As a check the stock liquid which had not been in the pitcher was subjected to the same test as the pitcher contents in each case, and the results were practically the same as with the pitcher fluid.

Olive oil and water, in the same proportions as those used in the case of *Sarracenia*, were placed in the pitchers of *Nepenthes* and the titration process was conducted in the same manner, but no digestion was detected.

The experiment with ethyl butyrate was repeated with the substitution of tap-water which had been in the pitchers of *Nepenthes* instead of *Sarracenia*, one day. No digestion was indicated.

IV. Effects on Protein

Fibrin. — Water which had been left in the pitchers of *Sarracenia* six days was removed and placed in bottles to each of which a granule of fibrin was added. As checks, toluol was added to some of these, dilute acid to others, and dilute alkali to a third set, the acidity or alkalinity being in each case below the harmful point as determined by the earlier experiments. Toluol was added to a portion of the acid and alkaline mixtures. The result was quite uniform, for the fibrin granule remained apparently unchanged in each liquid.

General Conclusions

The results of the above experiments may be summarized as follows:

1. The pitchers of *Sarracenia purpurea* can adapt themselves to solutions of very different osmotic strengths.
2. They give out an enzyme which hydrates sucrose and starch to reducing materials, presumably simple sugars.
3. They have no fat-digesting power.
4. They do not secrete a protein-dissolving enzyme.

In the tests which were made upon the pitchers of *Nepenthes* the resistance to solutions of marked difference in osmotic strength was shown to be the same as in the case of *Sarracenia.* The plants differed in that *Nepenthes* did not give out into the pitcher cavity any enzyme capable of hydrating sugar and starch, whereas *Sarracenia* did. The experiments as to protein digestion in *Nepenthes* were inconclusive, but they were not repeated partly because of insufficient material and partly because the demonstration of the existence of a protein-dissolving enzyme in *Nepenthes* by Vines (Ann. Bot. **12** : 545. 1898) was accepted as final.

Sarracenia purpurea belongs to the class of plants which, like the bromeliads of the tropics or our northern catch-fly, illustrates a mal-adaptation between plants and animals, for while they serve as traps for insects they are neither harmed nor benefited by them, unless the number be very great. In the sphagnum bogs where *Sarracenia* grows, the concentration of salts and nitrogenous matter about its roots is so great as to place them

practically under xerophytic conditions. This would tend to render the root system inefficient as a means of water absorption and make the possession of a water-storing organ like the pitchered leaf of great advantage to the plant.

The epiphyte *Nepenthes* represents the highest degree of adaptation, in that it produces a protein-dissolving enzyme, the nepenthin of Vines (Ann. Bot. **15**: 563. 1901). Even here, however, the absorption of protein by the leaves is not absolutely essential to the life of the plant, though of great advantage. *Nepenthes*, then, stands at the upper limit in the evolution of plants with pitchered leaves, while *Sarracenia purpurea* is near the lower limit. Between them are numerous forms with varying degrees of adaptation.

New York Botanical Garden.

SPECIES AND VARIETIES

By T. D. A. Cockerell

The recent discussions on the species question, particularly that of the Botanical Society, printed in the May number of the American Naturalist, show at least one thing — that the matter may be regarded from very diverse points of view. This being so evident I beg permission to add yet another to the already numerous collection.

Politically, I am an American; but biologically, an Englishman, with many of the idiosyncrasies of that singular race. According to current report, one of the peculiarities of the English is a limited sense of humor. I rather incline to the opinion that this is not wholly to their discredit; but nevertheless, I am far from proposing legislation to prohibit anyone from making a joke unintelligible to the Anglo-Saxon mind. Such restrictions have probably never been contemplated in respect to jokes, but are they not a little like those desired by botanists, who insist that all species must be discernible to general students of plants? Such persons talk about the *creation* of species by botanists, showing thereby, and in other ways, their opinion that species are purely artificial things. Their attitude toward species is something like

that of the legislators who, very properly, enacted laws about the size of the fourpenny loaf. In a certain sense of course they are perfectly right. The term species is applied to a particular kind of thing, not any more definable perhaps, than humor, but about as easily recognizable in the majority of instances. It is not permissible to call anything humor, or species, at random; but it must be recognized that these names do stand for realities, and that in either case these may be genuine enough, and yet overlooked by the majority of persons. If a species were not a real thing, a segregated object related to, but discrete from others such objects in a complex and wonderful world, all our discussion would be relatively meaningless; and those would be right who should urge that we occupy our minds with something more profitable.

While it is doubtless true that every taxonomist has good reason to complain of the conduct of all his colleagues, it seems possible, at least, that much of the lamentation which so frequently falls upon our ears is the result of mere inertia. Take the genus *Crataegus*, cited everywhere as a horrible example. In the old days, *Crataegus* was easy; the "species" were few, and had easily recognizable characters. If we could proceed without taking any account of the facts of nature the old system would have much to commend it — at least for those who prefer uniformity to variety, dullness to incident. We know to-day that American *Crataegus*, like the *Rubus* and *Hieracium* of Europe, is wonderfully polymorphic; and the study of this multitude of stars of the eighth magnitude offers as interesting and profitable work for the evolutionist as he could well desire. I have compared the species of *Crataegus* with minor stars, and the comparison is I think apt. They are separable entities, but of different grade of magnitude from ordinary species; amateur astronomers, as amateur botanists, may from preference or necessity confine their attention to the more visible units; but neither the *science* of astronomy, nor that of botany, has any right to such limitations.

As we gain knowledge, we see more and more clearly that "species" are of various grades and kinds: and it is eminently

desirable to devise a system which shall indicate this diversity. We are not yet prepared, I venture to think, to do this with complete success, but it is one of the necessities of the future ever to be kept in mind. In the meanwhile, any proposal to go back to the old system, and virtually ignore all the wonderful facts of segregation which have been revealed to us in recent years, is simply pernicious.

From the standpoint of convenience and intelligibility, it seems to me that there is much to be gained by the recognition of subspecies, with a trinomial nomenclature. The introduction of a new form as a subspecies when its precise status is uncertain, has at least the advantage of calling attention to its manifest affinities, and suggesting further work to determine the character and extent of the segregation. The proposal to deny subspecific names obligatory priority when the plants they represent are treated as separate species seems to me unfortunate, since it will assuredly have a strong tendency to cause writers to announce their novelties as full species whenever there is any possibility of their proving such, and will place more cautious workers at a disadvantage.

I cannot see much advantage in the proposal to distinguish minor forms or races by numerals. Imagine specific names replaced by numbers! Numbers are not only less interesting than names, but are more easily confused and misprinted, and when errors of this kind are made there is nothing to show what is wrong. Is it fair to hint that this botanical penitentiary-system for minor segregates is desired by those who really wish to relegate these things to comparative obscurity; whereas to some others, — *e. g.* the evolutionist and the horticulturist, they are of prime importance? The system of naming things is not peculiar to science; it is found useful to extend nomenclature as far as human interest can or will follow; thus every individual of *Homo sapiens* has a distinctive name, and if we had the sort of mind which is usually attributed to the deity, I suppose every individual plant would be esteemed worthy of a like distinction. As it is, the real question about races is, are they worth thinking about, talking about, and describing, considering our human limitations? The answer of modern biology surely is, yes!

A code system for parallel modifications seems eminently desirable, but I think it should follow the character of the modification, rather than the cause, the latter being often obscure. To designate a particular form as a "shade form," for instance, seems to me to artificially simplify matters and obscure the actual facts. With shade are usually associated increased moisture and decreased temperature; but in certain places and at certain times, the exact reverse is true. In all this, we come back to the great fact of the complexity of natural phenomena; and while we seek everywhere for general laws and find them in operation, we must not forget the Linnean motto: "Natura maxime miranda est in minimis."

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NOTES ON THE LIFE AND WORK OF CHARLES C. FROST *

BY WILLIAM A. MURRILL

Charles Christopher Frost, the "shoemaker botanist" of Brattleboro, Vermont, by integrity and simplicity of life and singleness of purpose in his work and in his recreation amassed a modest fortune and greatly advanced the knowledge of the flora of his native state.

A plain man, of great modesty, he repeatedly declined scientific positions and honors, and stuck to his trade of shoemaking during his entire working life, occupying the same shop for a period of forty-nine years. When asked the reason for this he replied, "Whatever I have acquired of science, in my life, came through search for health and mental entertainment; science is not my profession — shoemaking is." His character was formed along strictly puritanical lines, industry, simplicity, reserve, and deep religious conviction being its prominent characteristics.

Frost's success was due to a splendid intellect and close application. He had no advantages, except those afforded by a small

* Editor's Note. — This article forms an interesting introduction to Dr. Murrill's paper on the *Boleti* of the Frost Herbarium, which is to be published in the *Bulletin*.

village school kept open during the winter months, and this he left in his fifteenth year to help his father in the shop, resolving, however, to set aside for the rest of his life an hour each day for study. Mathematics first absorbed his attention, but a love for the natural sciences was soon acquired and this was fostered by collections of insects, shells, and other natural objects.

He became a botanist through the advice of a noted New York physician, whom he consulted regarding a severe case of dyspepsia with which he was afflicted. The physician frankly told him that he could do nothing for him, but that he could do everything for himself, and suggested that he devote an hour each morning and an hour each afternoon to the observation and study of plants in the field. Following this excellent advice, it was not long before Frost was on the road to health, and also to fame as a botanist. He purchased some botanical works and a good microscope, acquired a knowledge of Latin, French, and German, and devoted practically all of his leisure time henceforth to the study of plants growing wild in the region of Brattleboro. Excursions were often made in the early morning before the shop was opened, and during the day and in the evening he was rarely seen without an open book beside him. Half of the noon hour was regularly spent in the attic with his plants, and most of his microscopic work must have been done at that time. On rare occasions, when Sprague or some other intimate botanical friend paid him a visit of a day or two, the shop would be closed for the entire period; but it was by the faithful and constant use of the leisure moments of a busy life that most of his knowledge was acquired.

Frost's botanical work was done between 1845 and 1875. The published results of this work are very meager, consisting chiefly of catalogues of cryptogamic plants occurring in New England.* The first catalogue contained additions to the fungi

* Further Enumeration of New England Fungi. Proc. Boston Soc. Nat. Hist. **12**: 77–81. 1869.

Catalogue of Boleti of New England, with Descriptions of New Species. Bull. Buffalo Soc. Nat. Sci. **2**: 100–105. 1874.

A Catalogue of Plants Growing Without Cultivation within Thirty miles of Amherst College. By E. Tuckerman and C. C. Frost, 1875.

previously listed by his friend Sprague, of Boston, who turned over to him his remaining material in 1860 and asked him to continue the work. In the eight years that followed, Frost succeeded in adding 263 species to Sprague's revised list of 678. Only three of these additions were *Boleti*, and two of them were omitted from the Amherst Catalogue, as foreign to New England.

The second publication cited is a list of the 47 species of the genus *Boletus* found in New England, 22 of which were described as new. This is perhaps his most important work, judging from the standpoint of publication, since it contains descriptions, and not names only.

The third catalogue, prepared in collaboration with Tuckerman, is by far the most pretentious of his publications, being a summary of his entire botanical knowledge regarding New England mosses, liverworts, stoneworts, and fungi, so far as this knowledge could be expressed in a mere list of species. The work contains 98 pages, 44 of which are contributed by Frost, 36 of these being devoted to fungi. Under the genus *Boletus*, 46 species are listed, and one species each under *Strobilomyces* and *Fistulina*. Of the 1,190 species of fungi listed, 60 were first described by Frost, 40 of these being *Boleti* and gill-fungi.

In the absence of more extensive and detailed published results, it is no doubt true that Frost's herbarium represents his most valuable botanical work. This was retained by his family for ten years after his death, and then deposited by them, in 1890, with the Natural History Society of Brattleboro for a period of twelve years, when it was decided to transfer the entire collection to the University of Vermont. At that time the number of cryptogams in the collection was estimated at from three to five thousand specimens.

Frost's botanical library, consisting of about 100 bound volumes and various manuscripts and drawings, was also deposited with his herbarium. Among his most helpful books on fungi were some of the works of Berkeley, Cooke, Persoon, Fries, Schweinitz, Rabenhorst, Tuckerman, and Peck. Sprague sent him a number of his pen drawings of Agarics, and he had copies of many colored figures of *Boleti* taken from published illustrations.

The fungi were kept by Frost in paper boxes or glued flat to sheets of blank books. It is said that these were considerably disturbed soon after his death by visiting botanists. A number of the fleshy forms were much injured by mould but none was wholly destroyed, so far as I know. The specimens of *Boleti*, probably the cream of the entire collection, have been most generously placed at my disposal by the university authorities for critical examination, and the results of this study will be published in a short time.

NEW YORK BOTANICAL GARDEN.

REVIEWS

Lewis's Plant Remains of the Scottish Peat Mosses*

This study by F. J. Lewis of the plant remains of the Scottish peat bogs, of which Part 3 dealing with the eastern and northwestern Highlands, Shetland Islands, Outer Hebrides, etc., has just reached this country, is a model in English of the line of work so successfully pursued by Nathorst, Gunnar-Andersson, and others of their countrymen, but published for the most part in Swedish and Danish and consequently inaccessible to most students. While the sequence of events as found by Lewis in Scotland is somewhat variable as would be naturally expected when the varying physical conditions of deposition are taken into account, the general order is sufficiently uniform to enable him to make some very interesting correlations between the different areas.

The following is a somewhat generalized abstract of this march of events in the late Pleistocene: The oldest beds found (exclusive of the rock floor) are glacial sands and till which are referred to the fourth Glacial or Mecklenburgian stage. These are followed by desposits containing arctic plants, indicating tundra conditions. Upon these are superposed the peat deposits of the fourth Interglacial period with *Betula*, *Corylus*, *Potentilla*, *Menyanthes*, *Salix*, etc. This forest bed or scrub is gradually exterminated by *Sphagnum* and the indicated wet moorland condition persists to the fifth

*The Plant Remains in the Scottish Peat Mosses. By F. J. Lewis. Part 1, Trans. Royal Soc. Edinb. 41^3: 699–724. pl. i–vi. 1905; Part 2, Ibid., 45^2: 335–360. pl. i–v. 1906. Part 3, Ibid., 46^1: 33–70. pl. i–iv. 1908.

Glacial or Turbarian stage, represented by mountain glaciers, and arctic valley floras, at least towards its close. These consist largely of the herbaceous arctic willows such as *Salix reticulata* and *herbacea* with *Dryas octopetalata*, etc. The fifth interglacial is marked by a gradual amelioration of temperature, the arctic willows being replaced by a close growth of *Salix arbuscula* with *Potentilla comarum*, *Empetrum nigrum*, *Arctostaphylos alpina*, and other sub-arctic forms until finally the moor is converted into a forest with *Betula alba* or *Pinus sylvestris* predominating, the latter with an undergrowth of *Calluna*. These conditions are followed by increasing humidity and precipitation until wet moorland (*Sphagnum*) has replaced the forest and the climate becomes considerably cooler with slight alpine glaciation. Soon, however, the climate becomes warmer, more genial, and drier in fact than it is at the present time, and another forest of *Pinus sylvestris* of large size and with an undergrowth of *Calluna* and some *Corylus* and *Alnus* occupies the region. † Succeeding the pine forests is another era of wet moorlands (*Sphagnum*, *Scirpus*) which gradually changed to the present somewhat drier condition.

While it is regrettable that all of the plant forms discovered have not been identified and listed and while the manner of presentation is susceptible of improvement, the study as a whole is an extremely valuable one and shows the possibilities in a line of work almost wholly neglected in America. It is to be hoped that it will furnish a stimulus to botanists favorably situated in our own northern states and induce them to get a little way below the surface in their ecological studies.

EDWARD W. BERRY.

JOHNS HOPKINS UNIVERSITY.

AN EDITORIAL PLEA

A contemporary magazine writes as follows: We cannot expect the "man who pays" to continue to pay unless he receives value for his money, but the value of a scientific journal, unlike that of a popular magazine, is dependent entirely on gra-

† Proximity to the Atlantic caused the wet moorland to persist in western Scotland at this time.

tuitous contributions. It cannot buy its talent, but must take what material is sent to it.

This plaint must appeal strongly to all editors of scientific journals, but it could truthfully be made more pathetic still; for, while some editors groan because they "must take what material is sent," most editors moan because of the material that is *not* sent.

Several college professors have said that we have no good magazine devoted to general botany which they can recommend to their students. TORREYA, the more popular journal of the Torrey Botanical Club, would gladly enlarge its scope and increase the amount of its printed matter to become such a journal, but the most willing and aspiring editorial board must have material to edit.

The cruse of oil and the handful of meal have been ours — and that without dregs and scrapings — but help is needed from *more* of our club members and subscribers. That would mean a wider range of subjects and a better monthly selection and arrangement. Then, perhaps, TORREYA would be able to give regularly a scholarly paper on some general phase of botany, a shorter technical paper, at least one somewhat popular illustrated article, reviews of current botanical books and papers, some discussion of apparatus, materials, and methods of interest to teachers of botany, and news items of contemporary botanists and botanical movements. To accomplish this a full editor's drawer is necessary. Were it *once* well-filled, more subscribers or more of those "who pay" would be assured — with sufficient money for more numerous illustrations, which in turn would encourage authors TORREYA-ward.

JEAN BROADHURST.

TEACHERS COLLEGE.

OF INTEREST TO TEACHERS

The experimental work now included in the plant physiology of the high school varies greatly in the number and kind of experiments. More important, pedagogically, is the variation in method for "plant experiments" may mean any of the following: the passive observation of work done wholly by the teacher, or the completion — almost as passively — of certain, definite, and detailed exercises to reach certain and definite results, or the working out of questions in which the accompanying suggestions, the lack of definite, predicted results, or the practical applications required demand independent reasoning and, perhaps, allow some slight opportunity for originality in method or device.

The questions "Should the physiological work in high school botany be more or less quantitative? If qualitative only, how can correct ideas as to time, amount, etc., be assured?" which appeared in the March TORREYA have had several answers of interest. Those given this month are chiefly brief statements of the writers' opinions on the first part of the above question and in two cases lists of experiments are included. Later, TORREYA will print as part of this same discussion longer papers by Mr. Joseph Y. Bergen, author of various well-known text-books on botany and by Professor Julius Sachs, of the department of secondary education in Teachers College, New York City.

Fred L. Charles, DeKalb, Illinois. — Chiefly qualitative, but not wholly so. Experiments by the pulpils individually or in groups of two; also demonstrations by the pupils.

We are now using Osterhout's "Experiments with Plants."

Fr. Holtz, Brooklyn, New York. — I do not think first year students in the high school are able to do or appreciate quantitative work very much. I do not believe that much quantitative work is done anywhere with such students. I believe thoroughly in physiological experiments, however. A little notion of quantitative work may be given by making *comparative* or *relative* studies which are not exact in quantities.

Willard N. Clute, Joliet, Illinois. — Physiological botany, to best serve the most people, should be entirely qualitative. The trouble with all of us is that we are too much in awe of the college

and what it requires for entrance. The fact that so few take up botany in college is reason enough for our making the high school course such as described above.*

George W. Hunter, New York City. — Quantitative physiological work for the student of thirteen with the appliances he will find in the average New York home is out of the question. I prefer to set my problems for the student in such a way that he will work out the simplest kind of generalities himself. Then in the laboratory experiments may be set up and worked out as demonstrations. This shows to the student the value and place of *quantitative* work in the experiment — and often his own shortcomings.

Emmeline Moore, Trenton, New Jersey. — Physiological work in botany involves experimentaton of a quantitative as well as of a qualitative nature. It is true that the so-called qualitative experiments are more numerous than the quantitative ones in the lists of experiments which are usually performed but a plant is a living organism, and since it is a living organism "time" and "amount," in a general way, constantly enter as factors in the conditions which affect its life. A classification of experiments into quantitative or qualitative as such would tend to make the work, for the high school grade of pupils, artificial and mechanical and very probably obscure the principle involved in the experiment.

Elsie M. Kupfer, New York City. — I divide the physiological work in botany into two groups one of which includes experiments performed by pupils individually at home or in school, and the other those demonstrated by me in class. As my room is in use for work either by myself or some one else every period of the day, group work becomes impossible. I usually ask to have the experiment actually brought in, so as to avoid shirking.

The following list of the experiments performed by each pupil is not given in any related order:

1. On the force exerted by swelling seeds.
2. On the relation of water to germination.
3. On the relation of heat to germination.

* Editor's note. — See the discussion in the June TORREYA.

4. Food tests (starch, proteid, fats, and sugar) in all seeds studied (in class).

5. On response of roots to gravity.

6. On response of stems to gravity.

7. On conducting region of root.

8. On conducting region of stem.

9. Osmosis experiment to show the importance of water for rigidity of root (performed on carrot).

10. On positive phototropism of stem.

11. To prove that CO_2 is evolved by growing seeds (with lime water).

12. To prove that seeds use up oxygen in germinating.

13. To show transpiration.

14, 15. To show the functions of the veins of the leaf.

16. Etiolation experiment.

It seems to me that the qualitative side is all that we can profitably insist on in our high school course. I do not lay very much stress on the quantitative side, and doubt whether the conceptions of time and amount as applied to botany have very great value for pupils of this age.

L. S. Hawkins, Cortland, New York.— It seems to be advisable to take up the plant as a biological unit and in so doing to consider the general conditions governing the germination of seeds and the growth of seedlings. In this way we try to make the work, as far as possible with the apparatus at hand, quantitative. This work is followed by a series of experiments with the growth and function of the vegetative organs. I have tried two methods of having the experiments done. (1) Each student did each experiment. (2) One student from a group did one or more experiments and reported the results to the members of the group. In each case the results of the experiment were exhibited in the laboratory as material for demonstration of the explanation of the experiment. I find that the individual method is by far the more satisfactory. The number of pupils being so great in comparison to the room we have, we are obliged to have the experiments done at home and the results brought to class. I will enclose the list of experiments which represents the work done along the

line of physiological work. Of course you understand that in this State there is a definite course for every school to follow.

1. To test seeds for starch.
2. To test seeds for proteid.
3. To test seeds for sugar.
4. To test seeds for fat.
5. To test seeds for mineral matter.
6. To determine the temperature best suited to seed germination and the growth of seedlings.
7. To determine the relation of moisture to seed germination and the growth of seedlings.
8. To determine the relation of air to germination.
9. To determine what gas is given off by germinating seeds.
10. To determine the relation of light to seed germination and to the growth of seedlings.
11. To determine the effect of soil upon seed germination and the growth of seedlings.
12. To determine the use of the cotyledons to the seedling.
13. To determine the use of the endosperm to the corn seedling.
14. To determine the cause of the arch of the hypocotyl.
15. To determine where the increase in length in the root is most rapid.
16. An experiment to show osmosis.
17. To determine where the root hairs are most numerous.
18. To determine the direction of growth of roots when uninfluenced by gravity.
19. The use of the corky layer to the stem.
20. The path of sap in the stem.
21. To show transpiration.
22. To show photosynthesis.
23. To show respiration of aquatics.

Under the title "Organizing a field trip," H. M. Benedict has an article in the April number of the Nature Study Review which is particularly *à propos* at this season of the year. His discussion of the subject is from the standpoint of a course in general biology

but the matter contained is equally applicable to a course in botany. In his opinion, "The reason why the field excursion is so often unsatisfactory is that insufficient preparation is made for it. The plain fact of the matter is that a field trip requires more careful preparation on the part of the students than any recitation or laboratory period." He explains his methods by describing the preparation made for a specific trip. These include (1) a preliminary reconnaissance by the teacher of the region to be visited, and (2) a detailed outline and questions, similar to those in laboratory manuals, regarding the particular organisms to be observed. The pupils are to be drilled on these beforehand. Then, during the excursion, each is to discover for himself the answers to the questions given. The writer's plea is for excursions sufficiently limited in scope to allow of thorough work, and for careful preparation. He closes with the following: "The only seed from which a love of nature can grow is a fact personally discovered by the child. We may radiate the sunlight of enthusiasm and pour showers of loving appreciation but there can be no growth until the seed is planted."

RALPH CURTISS BENEDICT.

NEWS ITEMS

Dr. F. Noll, professor of botany at Halle, died on June 22 at the age of forty-nine years.

Mr. L. Lause Burlingame has been appointed instructor in botany in Stanford University.

Mr. C. E. Porter has been appointed professor of botany in the University of Santiago de Chile.

Dr. C. H. Shattuck, of Washburn College, has been called to the chair of botany and forestry in the State Agricultural and Mechanical College, at Clemson College, South Carolina.

Professor Edwin M. Wilcox, of the Alabama Polytechnic Institute, has been elected botanist of the Experiment Station and professor of agricultural botany in the University of Nebraska.

Dr. William A. Murrill, assistant director of the New York Botanical Garden, gave a two weeks' course of lectures in July

at the Biltmore Forest School on the fungi injurious to forest trees.

Dr. Raymond H. Pond, who returned to New York in May after courses of study in Jost's laboratories in Bonn and Strassburg, has been appointed biologist of the Metropolitan Sewerage Commission of New York.

Mr. C. F. Baker has resigned the position of curator of the herbarium and botanical garden of the Museu Goeldi at Para, Brazil, and has returned to Claremont, California, as associate professor of biology in Pomona College.

The Jamestown exhibition collection of models of fruits and vegetables, probably the most complete series of its kind that has ever been prepared, has been given to the United States National Museum by Mr. J. N. Léger, the Minister from Haiti. There are over one hundred models, including the following: cashew, ginger plant, mango, alligator pear, custard apple, pomegranate, guava, tamarind, naseberry, and bread fruit.

Massachusetts, justly termed a leader in economic reforms, has already appointed a State Conservation Committee to coöperate with the national committee recently appointed by President Roosevelt. The chairman is Mr. F. W. Rane, the state forester, under whose management much has recently been done to obtain and preserve forest lands, through the recent wise and generous provisions of the State Legislature.

The San Jacinto forest in California, one of the original thirteen national forests reserved by President Cleveland in 1897, has been renamed by President Roosevelt in honor of the President under whose administration the first national forests were created. Nearly 25,000,000 acres were at that time made into national forests upon the recommendation of the National Academy of Sciences, and in honor of Washington's one hundred and sixty-fifth birthday anniversary.

TORREYA

September, 1908

Vol. 8. No. 9.

BOLETI FROM WESTERN NORTH CAROLINA

By William A. Murrill

It was my privilege to spend two weeks during the past summer with Dr. C. A. Schenck, Forester of the Biltmore Estate, in Pisgah Forest, Transylvania Co., North Carolina, about fifty miles southwest of Asheville. Dr. Schenck's summer home is in Pink Bed Valley, 3,200 ft. above sea level, with surrounding ridges reaching a maximum elevation of 4,500 ft. The forest there is mostly composed of hardwood species, chestnut, oak, and tulip predominating, while pitch pine is found sparingly on the dry ridges and hemlock and white pine along the streams. Maple, birch, hickory, basswood, sourwood, black gum, black locust, butternut, ash, and Fraser's magnolia also occur as minor hardwood species. *Rhododendron*, *Kalmia*, and *Azalea* are exceedingly abundant, in many places forming impenetrable thickets which, when in flower, are visible from a distance as pink-colored masses or "beds."

About the middle of July, when I arrived at Pink Bed Valley, frequent showers had developed quantities of fleshy fungi, among them many boleti, which were collected and critically studied in the fresh condition, and afterwards dried by artificial heat. Dr. H. D. House very kindly assisted me in collecting, and the fact that several interesting species are represented by more than one or two specimens in this collection is largely due to his perseverance.

The following list includes practically all the species of Boletaceae collected during my stay in Pink Bed Valley arranged in alphabetical order under the generic and specific names commonly recognized in this country.

[No. 8, Vol. 8, of Torreya, comprising pages 181–208, was issued September 1, 1908.]

BOLETINUS PICTUS Peck.

Collected twice in considerable quantity, once in swampy ground and once on a dead locust log in low woods.

This species has the large radiating tubes of the genus *Boletinus*, and is easily distinguished among the Boletaceae by the conspicuous red scales that adorn its pileus and stem. It is fairly common in the woods and mossy swamps of the mountainous regions of the eastern United States. Edible.

BOLETUS AMERICANUS Peck.

Common, especially near pines.

This is a common and widely distributed edible species having a yellow, viscid cap usually dotted or streaked with red and a slender yellow stem covered with reddish-brown viscid dots which become black on drying.

BOLETUS AURIFLAMMEUS B. & C.

Five specimens were collected on a well-drained bank exposed to the sun about two hours just after midday. Dr. House afterwards sent me a number of fine specimens.

This species is of great interest, being very rare and very beautiful. It was originally collected in North Carolina by Rev. M. A. Curtis and sent by him to Berkeley, who described it. Peck found one plant at Sandlake, New York, and it was also reported by Beardslee from Brookside, West Virginia. The description given by Berkeley is both incomplete and inaccurate, but the bright golden-yellow color of the pileus and stem should easily distinguish it. The mouths of a few of the tubes sometimes appear scarlet, especially on drying, but this character is not at all conspicuous. The stem is beautifully reticulated.

BOLETUS AURIPORUS Peck.

Occasional on banks and in open woods.

This species may be easily recognized by its bright golden-yellow tubes which retain their color on drying. The cap is usually reddish-brown and the stem is viscid if the weather is not too dry. Edible.

BOLETUS BICOLOR Peck.

Several times collected on banks and in thin woods.

A beautiful species, with smooth purplish-red cap, bright yellow tubes, and smooth, red, or yellow stem. When broken both flesh and tubes change to blue. This plant has been reported from only a few localities. Beardslee reported it very common in the mountains of West Virginia. Edible.

BOLETUS CASTANEUS Bull.

Rare in sandy soil in open woods.

This species has a hollow stem and dries easily. The cap is reddish-brown, the flesh white and unchangeable, and the free tubes are at first white then yellowish. It is widely distributed and usually common. Edible.

BOLETUS CHROMAPES Frost.

Very abundant in open woods throughout the valley and on the adjoining slopes.

A very attractive species, and one easily recognized by its stem, which is bright yellow near the base and finely scabrous over its entire surface. The cap is pale-red and the tubes and most of the stem white. Edible.

BOLETUS CHRYSENTERON Fries.

Found a few times on roadside banks.

This species is widely distributed and usually common. The cap and stem are usually red and the tubes yellow and large. It dries easily, being spongy-tomentose in texture. The surface of the cap is soft, finely floccose, and often cracked. Edible.

BOLETUS CYANESCENS Bull.

Rather common in open woods, at times solitary, but usually gregarious.

A common and widely distributed plant easily known by the deep-blue color which its flesh and tubes assume when wounded. The cap is pale-tan and floccose-tomentose, the tubes and hollow stem white or pallid. It dries very readily.

BOLETUS EXIMIUS Peck.

Several times collected in thin woods and along roadsides.

The stem of this species is very characteristic, being lilac-gray and furfuraceous, while the cap and tubes are chocolate-brown. This species has been rarely reported, but I have it from New

England, New York, and Virginia, as well as from North Carolina.

BOLETUS FELLEUS Bull.

Collected only once or twice, but probably common later.

This abundant and widely distributed plant is easily known by the bitter taste of its flesh. The tubes are flesh-colored and the cap usually some shade of brown. When fully grown, it is sometimes over a foot in diameter. Said to be poisonous.

BOLETUS FUMOSIPES Peck.

Rather common on shaded roadside banks.

This species has been almost unknown except to Professor Peck, who described it in 1898 from material collected at Port Jefferson, Long Island. Professor Atkinson found it in abundance in North Carolina, and I collected it also in Virginia. It is peculiar in having a pale bluish-green band at the top of the stipe. The cap is also very reticulate-rimose, and the tubes an unusual grayish-white, afterwards discolored by the deep ochraceous-brown spores. When once seen, it is difficult to confuse it with any other species.

BOLETUS GRACILIS Peck.

Collected three or four times, but only one plant was found on each occasion.

This species is not generally well known, although said to be abundant in some localities. It belongs to a small group having flesh-colored spores, which tinge the white tubes at maturity. *B. felleus*, *B. indecisus*, and *B. nigrellus* are large plants with thick stems, from which *B. gracilis* is easily distinguished by its slender habit and small size.

BOLETUS GRANULATUS L.

Common, preferring open places in woods, and found more abundantly near pines.

This species is quite common in the eastern United States, usually appearing in scattered groups near pine trees. The cap is very slimy and brownish when moist, changing to yellow on partial drying; the tubes and stem are yellowish, with viscid dots which become black on drying. It is rather easy to confuse this species with *B. americanus*. Edible.

BOLETUS GRISEUS Frost.

Quite common in open places in woods.

This species is very similar to *B. retipes*, but is easily distinguished in the field by its pure white tubes, those of *B. retipes* being decidedly yellow. The cap is gray and the stem usually whitish. Edible.

BOLETUS INDECISUS Peck.

One of the most common species, occurring in clusters and colonies especially in clayey soil along the edges of exposed roads and trails.

This species is closely related to *B. felleus*, from which it is distinguished by its mild taste, that of *B. felleus* being decidedly bitter.

BOLETUS LURIDUS Fries.

Collected in abundance, especially on clay banks along roads.

This species, said to be very poisonous, may be at once distinguished from the other species mentioned here by the reddish-orange mouths of its tubes, the interior of the tubes being yellow. When cut, the entire cut surface of cap, tubes, and stem changes at once to blue. All boleti with red or reddish tube-mouths should be avoided when collecting mushrooms for food.

BOLETUS LUTEUS L.

Collected three times in open sandy soil in woods.

Cap very viscid, yellowish-brown; tubes and stem yellow, the latter dotted and also provided with a large white annulus. This is a well-known and widely distributed edible species commonly found in coniferous woods.

BOLETUS MINIATO-OLIVACEUS Frost.

Rather common in open woods near roads and trails.

Cap vermilion, tubes bright yellow, stem yellow with pink markings. This species is easily distinguished among the red boleti by its quick change to blue at any point, either outside or inside, where bruised or even touched with the fingers. It is reported from New England south to West Virginia, and is said to be poisonous.

Boletus Morgani Peck.

A single fine specimen was collected by Dr. Schenck on one of the mountain trails. After my departure Dr. House found several specimens, which he sent to the Garden Herbarium. Dr. Harper also collected it recently in Georgia.

This is a rare species, described from Kentucky and found in Virginia and one or two other states. Cap viscid, smooth, perfectly glabrous, shining testaceous; tubes flavous, becoming greenish from the spores; stem very long and rough with deep reticulations, flavous above, purplish-stained below. The long rough stem should distinguish it from all other boleti except *B. Russellii*, which differs in having a dry, tomentose cap.

Boletus Peckii Frost.

One of the most common species, usually along the roads in rather open woods.

Easily recognized by its red cap with a bloom like that of a peach. The tubes and upper part of the stem are yellow, the remainder of the stem red, and the whole surface reticulated. The stem of *B. speciosus* is entirely yellow and that of *B. bicolor* is not reticulated. Reported edible.

Boletus Ravenelii B. & C.

About ten plants were collected in all, some of them very fine. Dr. House later found many more. This was one of the few species that preferred the deep shade of the mountain laurel.

Cap dull reddish, both it and the stem covered with a light yellow powder, by which the plant is readily distinguished. The conspicuous veil was found more than once covered with a print of the olive-green spores. As the stem elongates, part of the veil remains attached to the margin of the cap and part forms a clinging cortina on the stem. I tasted the flesh and found it sweet. This beautiful species has been several times reported in the eastern United States, but it is not abundant.

Boletus retipes B. & C.

A common species in thin woods.

This species was first described from plants collected by Curtis in North Carolina. It has since been found quite commonly in

the eastern United States, and as far west as Wisconsin. The cap varies from yellow to brown, the flesh and tubes are yellow, and the yellow stem is beautifully reticulated to the base.

BOLETUS SCABER Fries.

Common in various habitats.

This is one of the best known and most abundant of all the species of boleti. The scabrous stem and the unchanging white flesh and tubes should distinguish it, in spite of the variable colors of the cap. Edible.

BOLETUS SPECIOSUS Frost.

Not rare in openings in woods.

This beautiful species is easily known by its apple-red cap without a bloom and its brilliant yellow tubes and stem, the latter reticulated. *B. bicolor* and *B. Peckii* are related species.

BOLETUS SEPARANS Peck.

A very abundant and very handsome species, found usually in open woods near the roads and trails. Also found in abundance at Falls Church, Virginia, during the latter part of July.

Cap and stem brownish lilac, the latter reticulated; flesh and tubes white; spores yellowish-brown.

BOLETUS SUBTOMENTOSUS L.

Quite common along roads and trails.

This widespread plant has been reported from many parts of America. It is one of the boleti that may be dried in the sun, being of a spongy rather than a fleshy texture. The cap is usually yellowish-brown or olive-tinted, with a distinct tomentum, and the large tubes and stem are yellow. *B. chrysenteron*, a closely related species, usually has more red both in cap and stem. Edible.

Boletus Vanderbiltianus sp. nov.

Pileus subconical, 2–3 cm. broad, 1–2 cm. thick; surface smooth, dry, conspicuously ornamented on the umbo with dense, pointed, imbricated, dark purple scales, which become gradually smaller and give place to minute purplish specks near the margin, the color changing from atropurpureous to latericeous; margin thin, undulate, concolorous, with a distinct inflexed sterile portion 1 mm. broad: context thick, fleshy, firm, cream-colored, unchange-

able, sweet to the taste; tubes adnate, slightly decurrent on one side, salmon-colored near the margin, incarnate next to the stipe, unchangeable within, the mouths becoming incarnate as the spores mature, mouths angular, 1 mm. or less broad, elongated to 2 mm. near the stipe, edges thin, entire: spores oblong-ellipsoid, smooth, pale ochraceous-brown, $9–12 \times 2–3\,\mu$: stipe curved, cylindrical, slightly enlarged above, delicately pruinose, not reticulated, deep salmon-colored, changing to incarnate, finely purplish-dotted like the margin of the cap, solid and cream-colored within, $2–3 \times 0.5$ cm.

A solitary specimen of this very beautiful little species was first found by the writer on the roadside in thin oak woods. Dr. House later collected several specimens of it and sent them to me. He reports it a slower grower, requiring three to five days to develop from the button stage, and its maximum height is rarely more than four centimeters.

FISTULINA HEPATICA Fr.

Common on chestnut stumps.

This well-known and widely distributed edible species is easily recognized by its resemblance to a piece of beefsteak. It is found almost exclusively, in this country, on chestnut and oak stumps.

FISTULINA PALLIDA Berk. & Rav.

Found only once on the base of a small decayed chestnut tree by the roadside.

This species probably occurs throughout most of the eastern United States, but it has been rarely collected. The cap is paler in color than that of *F. hepatica* and the stem is longer and more branched. These characters, with the white flesh, should easily distinguish it.

STROBILOMYCES STROBILACEUS (Scop.) Berk.

Abundant on shaded banks along roads and trails.

This species is blackish and shaggy, with white flesh, which on being cut or broken changes to reddish and finally to black. It is abundant everywhere in the woods, and is often collected for food.

KEY TO THE ABOVE SPECIES *

* See key to groups in TORREYA for March, 1908.

A. Cap red, without and within, stem very short. *Fistulina hepatica*

Cap fawn-colored without, white within, stem much longer and branched. *Fistulina pallida*

B. Tubes large, arranged in radiating rows; pileus and stem adorned with conspicuous red scales. *Boletinus pictus*

C. Pileus blackish and shaggy; flesh white, changing to reddish when bruised. *Strobilomyces strobilaceus*

E. Stem annulate and glandular-dotted. *Boletus luteus*

F. Pileus yellow, often streaked with bright red; stem slender, 8 mm. or less in diameter. *Boletus americanus*

Pileus brown when moist, yellowish on drying; stem stouter, over 8 mm. in diameter. *Boletus granulatus*

G. Stem shaggy and lacerate, with deep reticulated furrows; cap viscid and glabrous. *Boletus Morgani*

H. Flesh and tubes becoming deep blue when wounded. *Boletus cyanescens*

Flesh and tubes white or yellowish, unchanging when wounded. *Boletus castaneus*

I. Stem and pileus covered with a conspicuous yellow powder. *Boletus Ravenelii*

J. Pileus large, stem 1 cm. or more thick.

Flesh decidedly bitter. *Boletus felleus*

Flesh not bitter. *Boletus indecisus*

Pileus small, stem about 5 mm. thick. *Boletus gracilis*

K. Tubes yellow within, mouths reddish-orange. *Boletus luridus*

L. Stem entirely white or grayish-white. *Boletus scaber*

Stem conspicuously bright yellow near the base. *Boletus chromapes*

M. Pileus gray, tubes white. *Boletus griseus*

Pileus yellow or brown, tubes yellow. *Boletus retipes*

Pileus red.

Stem bright lemon-yellow throughout. *Boletus speciosus*

Stem red below, yellow above. *Boletus Peckii*

N. Tubes white, afterwards colored by the ochraceous brown spores. *Boletus fumosipes*

Tubes salmon colored, spores yellowish-brown. *Boletus Vanderbiltianus*

Tubes yellow or greenish-yellow.

Tubes changing to blue when wounded.

Pileus subtomentose. *Boletus chrysenteron*

Pileus glabrous.

Pileus bright red to olivaceous, the entire plant quickly turning blue at any point where touched. *Boletus miniato-olivaceus*

Pileus dark red, not sensitive, changing color slowly or not at all when bruised. *Boletus bicolor*

Tubes not changing to blue when wounded.

Pileus subtomentose, tubes becoming greenish-yellow. *Boletus subtomentosus*

Pileus glabrous, tubes remaining a beautiful golden-yellow even after long drying. *Boletus auriporus*

O. Stem and pileus bright golden-yellow; plant small. *Boletus auriflammeus*

Stem brownish-lilac or chocolate-brown.

Stem reticulated. *Boletus separans*

Stem furfuraceous, not reticulated. *Boletus eximius*

EW YORK BOTANICAL GARDEN.

A NEW CRETACEOUS BAUHINIA*

BY EDWARD W. BERRY

The genus *Bauhinia* Linné of the Caesalpiniaceae has upwards of one hundred and fifty species in the modern flora with representatives in the tropics of America, Asia, Africa, and Australia. A fossil species based on leaf remains from the Tortonian or Upper Miocene deposits of OEningen, Baden, was described by Heer as long ago as 1859.† Soon afterward Unger in his *Sylloge plantarum fossilium* described two additional species,‡ both based on pods, from Croatia. The discovery of a handsome species in the much older Cretaceous deposits of New Jersey was made the occasion of an interesting communication to the Torrey Botanical Club by Professor Newberry in 1886 § and this and another larger species were subsequently fully described and illustrated in his monograph of the Amboy clay flora.|| Meanwhile Unger had described a species from the Aquitanian of Kumi on the island of Euboea off the eastern coast of Greece¶ and Velenovsky had described a leaf from the Cenomanian of Bohemia under the name of *Phyllites bipartitus*** which he considered as a probably abnormal leaf of *Hedera primordialis* Saporta but which as Newberry suggested is almost certainly another species of *Bauhinia* (*l. c.* 1896), and more closely related to the existing oriental species than to those of America.

Quite recently the writer discovered Newberry's *Bauhinia cretacea* in collections from the Tuscaloosa formation of Alabama, and from higher levels in the same formation a large and ornate leaf of a new species belonging to this genus.

The occasion for this brief note, however, is the discovery of

* Published by permission of the Maryland Geological Survey.

† Heer, Fl. Tert. Helv. 3: 109. *pl. 134. f. 21.* 1859.

‡ Unger, Sylloge 2: 31. *pl. 11. f. 2, 3.* 1862.

§ Newberry, Bull. Torrey Club 13: 77, 78. *pl. 56.* 1886.

|| Newberry, Mon. U. S. Geol. Surv. 26: 91, 93. *pl. 20. f. 1; pl. 43. f. 1–4; pl. 44. f. 1–3.* 1896.

¶ Unger, Foss. Fl. v. Kumi, 61. *pl. 15. f. 36.* 1867.

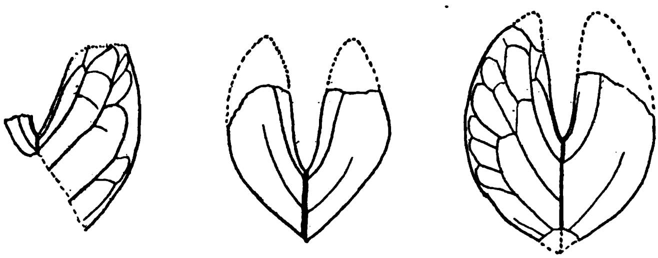
** Velenovsky, Fl. bohm. Kreidef. 4: 12. *pl. 6. f. 4.* 1885.

a very distinct smaller-leaved species in the Magothy formation at Grove Point, Maryland. This may be characterized as follows :

Bauhinia marylandica sp. nov.

Leaves small, about 3 cm. in greatest length by 2.5 cm. in greatest breadth, elliptical in general outline, bilobate ; the apical sinus narrow and pointed, reaching one-half to two-thirds of the distance to the base ; lobes narrow, ascending, somewhat falcate in outline, obtusely pointed ; midrib straight, giving off one, two, or three sharply ascending pairs of opposite, camptodrome secondaries, which give off a series of broadly rounded inequilateral tertiary arches which are directed upward and outward ; the upper pair of secondaries the most prominent ; from the juncture of the midrib and sinus a pair of much reduced secondaries is given off and these join the secondary next below in one or two broad arches.

The form and venation of these leaves is exactly like several of the existing forms and is so well marked that there can be no doubt of the existence of a species of *Bauhinia* growing along



the coast of Maryland during the deposition of the Magothy formation, a species whose descendants along with those of its Cretaceous congeners migrated finally to their present tropical habitat, perhaps gradually with the oscillation of climatic conditions, and perhaps not until the Pleistocene glaciation to the northward forced them to make a comparatively sudden retreat to the southward.

JOHNS HOPKINS UNIVERSITY,
BALTIMORE, MARYLAND.

SHORTER NOTES

A Teratological Note on Timothy.— The usual farm crops afford many instances of double (and sometimes triple) fruits. Such specimens of red clover and field corn are rather common. I have never noticed such abnormalities in timothy, however, until this year, when a partially double head of timothy was found in our lane. The whole head is 7.6 cm. long, being single for 4 cm. of its length and having the upper part divided into two stalks of 3.6 cm. each. The upper divisions are almost equal in diameter to the basal part, and are fully fruited, except occasionally on the inner sides. The divisions diverge at an angle of 35 degrees.

H. R. Romine.

Abnormalties in the Radish, Clover, and Ash.—Several seedlings of the radish grown by our students this year in their seed germination studies had one cotyledon some distance below the other; in one instance the cotyledons were 3 cm. apart. A specimen of white clover, *Trifolium hybridum*, was found along the roadside this June with seven large flowerets 2.3 cm. below the head itself. The flowerets of the head were perhaps not so numerous as usual. From an American ash tree near our school buildings I picked several leaves which to me seemed very unusual. There were two sets of leaflets instead of one set at the nodes along the rachis; some had three pairs of such doubles instead of three pairs of leaflets.

Emmeline Moore.

New Jersey State Normal School.

REVIEWS

Knuth's Handbook of Flower Pollination*

The first volume of this series containing 381 pages and 81 figures appeared last year. It considers the modes of pollination and the types of flowers and their insect visitors, special attention being given to their structure and mutual adaptability.

* Knuth, Paul. Translated by J. R. Ainsworth. Volume II, Handbook of Flower Pollination, Large 8vo, viii + 703. f. 1–210. 1908. Oxford, Clarendon Press. Cloth 31s. 6d. Half morocco, 35s. net.

The second volume with a portrait of Hermann Müller, upon whose studies the series is based, has now appeared. This volume is special in nature and contains "an account of all known observations upon the pollination of the flowers of plants of Arctic and Temperate zones." From the contents, however, we infer that it is devoted to certain groups of dicotyledones ranging from the Ranunculaceae to the Stylidieae. The sequence of the groups is somewhat different from the arrangement with which we are familiar and to give an idea of their arrangement and of the scope of the work mention may be made of the more important orders and families, employing the classification in common use in this country: Ranales, Papaverales, Violaceae, Polygalaceae, Caryophyllaceae, Portulacaceae, Hypericaceae, Malvales, Geraniales, Sapindales and Rhamnales, Rosales, Myrtales, Passifloraceae, Cucurbitaceae, Cactaceae, Umbellales, Rubiales, Valerianales, and Compositae which includes our Carduaceae and Cichoriaceae.

The remaining families and orders will be discussed in the third volume, while the fourth and final volume has been advertised to deal similarly with plants outside Europe. The orders mentioned above are not recognized in the discussion, the species being arranged in fifty-six orders that correspond to our families. For example the Ranales are discussed under six orders and the Sapindales and Rhamnales are represented by six orders promiscuously intermingled. The families (orders) of an alliance are also very generally taken up in the reverse order of their complexity. The rose group begins with the Leguminosae and follows with the Rosaceae, Saxifrageae, and Crassulaceae, though the Myrtales may possibly be cited as a reversal of this treatment in which the reduced Halorrhagidaceae (Halorageae in the text) are followed by the Melastomaceae, Lythrariae, and Onagrariae. Just what purpose the authors had in mind by this reversion of sequence — of going up the biological scale backward so to speak — is not clear. We take it that an attempt has been made to represent in this arrangement of the families, their natural relationship. In some cases the sequence is a very probable one, as from the Umbellales to the Rubiales, Valerianales, and Compositae; but in other cases the arrangement is unusual to

say the least, as for example the association of the Violaceae, Polygalaceae, and Caryophyllaceae, in the order given, these groups following the Resedaceae and leading to the Hypericaceae. No attempt has been made to comply with the terminology now commonly employed and we find the so called orders ending in a great array of final syllables, partially illustrated above in the references to the rose and myrtle alliances.

The illustrations are deficient in number and lacking in quality. A criticism of this nature need rarely be passed on the superb book work of the Clarendon Press; indeed, it seems a pity to mar so excellent a book as this with inferior drawings which at times might almost be termed grotesque. Little care has been bestowed upon the size of the figures. A diagram of *Lythrum*, dealing with only gross morphological characters, is given a half page, while many illustrations of Cruciferae, Rosaceae, etc. are so reduced as to obscure the relationship of the organs. The figures are often overshaded with the result that they lack clearness or are even smudgy.

The only means of referring to the numerous species in the text is to be found in the index of the fifty-six orders that follows the title page. We understand that a full index will be included in the final volume but the publishers should have recalled that this volume will be extensively used by students as a reference book and that the lack of an index is a serious disadvantage. A similar deficiency is the lack of a glossary, especially since terms are employed that are not universally current.

The above criticisms, however, are of minor consideration and are not intended to reflect upon the excellence and worth of the discussion. The treatment accorded the orders, genera, and species will be universally appreciated by those interested in this phase of botany. The citation of the literature, and the discussions of the morphological and biological features of the flower, make the book indispensable as a work of reference. Much adverse comment has been passed upon ecological studies of this nature that have been so well developed upon the continent. We feel, however, that they are of great importance and know of no better way of introducing the study of flowering plants to

the student and of arousing his interest in it. Furthermore, it is worth one's time to learn the real significance of the morphology of the flower and to understand that it has a purpose other than to furnish means for the identification of the plant.

CARLTON C. CURTIS.

COLUMBIA UNIVERSITY.

OF INTEREST TO TEACHERS

QUANTITATIVE WORK IN HIGH SCHOOL SCIENCE COURSES

BY JULIUS SACHS

From the general standpoint of the object of secondary education, and not from the point of view of a science expert, I offer you a few comments on the influence of quantitative work in our high school science courses. It is claimed that no science is worth teaching, especially no physics, that does not make for quantitative accuracy; the college officers, however, who imbue the future teachers with this view, know very little of the hesitancy and helplessness of our high-school students; they do not know, as teachers of long experience know, that the steps of the students must be carefully directed in their experimentation, and that there is much more than unaided performance in the observations they record. It is safe to say that even if the students grasp the topics handled in this mathematico-physical work, they certainly fail of seeing the larger relations of the individual experiment to the world of physical phenomena. I am inclined to reverse the usual estimate that teachers place on the relative importance of their work in the high school; to me the most valuable and most important part of the work is that effected with pupils who cannot or will not advance to the college stage; for them surely, and I should like to add for *all* high-school students, it is important that they should be led to comprehend the physical, chemical, and biological elements that enter into the various industrial, agricultural, and mechanical problems. If then you wish to add a special fundamental training along the line of quantitative work, let that constitute an advanced course

for the few. The fact that in subjects appealing especially to boys and girls the initial interest wanes and that there is a diminishing choice of scientific subjects by our students proves not that pupils shirk serious work, but that much of our present science teaching is misdirected. Whatever the degree of specialization that may be desirable in a college instructor of science, the high school requires teachers of breadth of view; you cannot satisfy the pupil's desire for a broad outlook into the interrelations of phenomena, unless you yourself possess it. Too many of our teachers believe themselves discredited in the eyes of their associates, if they profess interest in three or four related fields of scientific inquiry; we cannot too soon revert to the type of scientific teacher that the Huxley school stood for — the man who sees the application of natural laws in several fields of organic and inorganic science. This need not involve superficiality; a teacher may still be preëminently interested in one line of inquiry, and yet recognize the duty of arousing his pupils to the relationship that pervades the world of phenomena.

TEACHERS COLLEGE.

QUANTITATIVE WORK IN HIGH SCHOOL BOTANY

BY JOSEPH Y. BERGEN

In reply to your request for an opinion in regard to quantitative work in high school botany I am glad to say a few words.

The question is really a general one — the high school teacher of almost every science subject, from chemistry to botany, has had to ask himself whether any quantitative work should be done, and if it is undertaken what proportion of the total laboratory time it should occupy and what degree of accuracy is to be required.

To me it seems that both extremes are wrong. Some of the worst-fitted candidates for the Harvard University entrance examination in physics used to come from schools on the one hand in which hardly any measurements of objects which could enter the jaws of a micrometer caliper were made without its agency, or from schools on the other hand in which the teacher's

demonstrations of physical principles were only less entertaining than the monthly public declamations or the recitals of the banjo club.

It would seem to be folly to bar out from the laboratory work in botany such studies as those on the blanching effect of cutting off light from green portions of the plant body, because it is not easy to express the effect in convenient units. So, too, it is well worth while to have every student produce positive and negative heliotropic movements in convenient portions of the plant body, and yet it would be an unprofitable labor to determine exactly what per cent. of the total sunlight is required to initiate such movements. But even the beginner in botany (of high school age) cannot get out of his subject nearly all that it can give him unless he has made some careful quantitative studies, not all of them necessarily physiological. For example, a few of the topics which readily lend themselves to quantitative treatment are: the relation of temperature to germination, to asexual reproduction (as in bacteria and yeasts), the percentage of water in the plant body, the effect of lowered temperature on root absorption, the approximate pressure of the root tip, the effectiveness of corky epidermis in preventing evaporation, the relative transpiration rates at various temperatures, critical temperatures and illuminations to produce nastic movements of foliage leaves and floral leaves, the minimum illumination for typical shade plants, and the number of competitors on a unit area of weedy soil. If the teacher has not had considerable practice in making quantitative studies of the character of those here mentioned, he may find it highly profitable to complete a goodly number of them and then endeavor to make a statement of the comparative accuracy and vitality of his knowledge of each topic before and after subjecting it to quantitative investigation.

If botany is to stand as an important subject in high school courses it must claim a place there not only because it fosters a love of nature and cultivates the esthetic sense — and these it should do — but also because it affords training in careful observing and scientific thinking. Will the botany teacher who objects to quantitative laboratory work be good enough to

suggest to those of us who do believe in it any substitute for such work which can be guaranteed to go as far in developing rigorous habits of thought?

CAMBRIDGE, MASSACHUSETTS.

Starch grains are made the subject of a recent paper by Professor Henry Kraemer, of Philadelphia. Among the statements of interest to high school pupils are the following: The starch grain consists of two nearly related substances, the one a colloid, which takes up aniline stains, and the other a crystalloid, which becomes blue with iodine. The starch grain is made up of concentric layers, one series of which contains a large proportion of crystalloids, while the other alternate layers are composed mostly of colloids. While heating the starch grains in water rapidly changes the structure of the grain, it is only upon the addition of chemicals or ferments that denaturization is brought about.

Dr. John W. Harshberger has recently found a slime mould which had left its saprophytic habit, assuming a grass-killing one. The slime mould, *Physarum cinereum* Pers., formed over night "patches of blackened grass," and in "a few days these black patches, if disturbed with the foot or a stick, gave off little clouds of dark brown spores. The original patches were small and few in number, from 6 to 12 inches in diameter and of irregular shape. The rains and damp weather of early August, 1905, aggravated the injury to the lawn, for the patches spread over much larger areas and covered portions of lawn 25 feet in diameter, of irregular outline, with smaller patches scattered in the circumscribed space." The disease affected only the leaves, for the above-mentioned patches afterward regained their fresh, green color.

The May *Bulletin* of the Torrey Botanical Club, contains an article by Harry P. Brown on algal periodicity in certain ponds and streams in Indiana which were studied throughout the year. Among the conclusions reached the following are of general interest:

1. An alga growing under steady normal conditions continues, in the region studied, to grow in a healthy vegetative state throughout the year.

2. A sudden change in external conditions checks the vegetative growth of an alga and tends to cause it to enter a resting stage or to form fruit sexually.

3. *Spirogyra varians* is the most widely distributed alga found in this region. It grows under varied conditions. It conjugates at all seasons of the year, depending on hard external conditions, *e. g.*, the drying up of the pond.

The Bureau of Plant Industry has recently given to *Science* authoritative statements regarding the nature of its seed and plant distribution. Among the beneficial activities thus described are the introduction of rapidly growing Arabian alfalfa, which at Mecca, California, last year yielded twelve cuttings instead of eight; the distribution of two new timothies, one of which ripens with red clover, the other being a large yielder; the successful introduction of the date in California and Arizona; the distribution of improved melon, cotton, and tobacco seeds; the introduction of thousands of Japanese rush and sedge plants for the matting industry; * and the department is at present importing hard bamboos from China, drought-resistant forms from India, and giant forms from Porto Rico.

An article on "Plant Pathology in its Relation to Other Sciences," by Dr. Ernest Shaw Reynolds in *Science* for June 19, contains the following: "We must know the normal functions of the plant attacked, and be able to realize in what way they have been deranged. Thus, if a parasite is the cause of the disease, it may bring about the death of the host-plant in one or more of the following ways: It may strangle the plant by clogging the water-conducting vessels, as in the bacterial "wilt" of melons, already referred to. Again, it may give out a poison which kills the pro-

* Editor's Note. — The New York *Tribune* for September 16 announces that in Saskatchewan "hundreds of square miles of reeds available for matting" have been discovered; the credit is apparently due to the United States government.

toplasm of the cells affected, as De Barry describes for one of the *Sclerotinia* diseases. The third method is by absorbing the food, water, or the protoplasm itself, from the cells of the host. This seems, at the present time, to be the most common mode of attack, especially in those diseases, like leafspots, which remain localized in some organ."

Dr. L. B. Walton, of Kenyon College, has made a study of zygospores of *Spirogyra quadrata* (Hass.) Petit to obtain data bearing — in part — upon the causes tending to produce variability. Over 400 zygospores were studied, including those formed by scalariform and by lateral conjugation. "In the first instance (scalariform conjugation) we deal with the results of conjugation between remotely related cells belonging to different filaments. In the second instance (lateral conjugation) we deal with the results of conjugation between sister or adjacent cells of the same filament, a condition closely related to the phenomena of parthenogenesis in other organisms. If the conjugation of germ cells from remotely related individuals tends to variability as Weismann and others would have us believe, conversely the union of closely related cells should afford a decreased variability, the minimum appearing in parthenogenetic forms.

"The results show a condition directly contrary to this, the zygospores of lateral conjugation being approximately 21 per cent. more variable in length and 21 per cent. more variable in diameter than those produced by scalariform conjugation. Consequently direct evidence is afforded in support of the theory of Hatschek (1887) that sex exists for the purpose of limiting and not for the purpose of increasing variability."

Science for May 22, 1908, describes the concerted action of the "owners of timber in different parts of the country in organizing associations to protect their holdings from fire. In the Pacific northwest, the Washington Forest Fire Association has just elected officers at Seattle and begun work for the year with 3,000,000 acres under its care. The plans include a system of patrol by rangers resembling the work done by the United

States Forest Service in guarding against and extinguishing fires. Organizations of similar kind and for a like purpose are at work in Oregon and Idaho. In the latter State, a portion of the expense is borne by taxation and paid from the State Treasury. A western railroad company which holds large tracts of timber has taken steps to guard its property from fire, and during the short time that its plans have been in operation, it has met with most encouraging success. Similar work is being done on the other side of the continent. Forest owners in Maine have gone to work in the same systematic way to control the forests' great enemy, fire. Like organizations are found in other parts of the country, showing how fully it is now realized that protection against fire is of the greatest importance. It is safe to say that fires in this country have destroyed more timber than lumbermen have cut. When timber was abundant, the waste passed almost unnoticed, but now that a scarcity is at hand and an actual wood famine threatens in the near future, the owners of forest lands are waking up and taking action to save what is left." The extensive fires in British Columbia and northern United States this summer emphasize the importance of such measures for the preservation of our forests.

The *Plant World* for May contains an article on "Leather from Cacti: Something New," by Frederick C. Wright. The author says that, "One day, over a year ago, the writer, while handling a piece of bisnaga (*Echinocactus wislizeni*) noticed, after the water it contained was pressed from the fiber," that it became very pliable and strong, like leather, but brittle and chalk-like when dry. Then, "not being a scientist," he began a series of crude experiments to obtain both strength and pliability, which he describes as follows: "I boiled the fiber with mesquite bark and burnt rags to tan and color it. I secured the color, but the fiber did not tan. I soaked it in oil; I used aluminum palmitate, tannic acid, gum arabic, caoutchouc, and I used glue, but none of these gave results. But, late one night soon after, I went to bed and slept the sleep of contentment, with a piece of perfect leather made from cactus fiber in my hand. I used water and glycerine, about

25 per cent. of the latter." On account of the large proportion of water contained in a bisnaga or sahuaro, if the fiber is cut one half inch thick it reduces to about one sixteenth of an inch in thickness. "If a circumferential cut is made (as one would peel an apple) from 20 to 40 feet in length of fiber may be obtained from cacti of the larger growths." "Immediately after cutting the fiber is placed direct in the tanning bath. The tanning process requires from two to three hours, according to the thickness of the fiber," but the drying process is more tedious. As much water as possible is first pressed from the sheet, after which it is hung up to dry, or dried by artificial heat. When dry the leather is white or tan, and may be stained any color desired. "The entire trunk of this giant, which reaches a height of 40 to 75 feet and a maximum diameter of two feet, may be utilized in the manner described, and, as the sahuaro covers an area of 120,000 square miles in Arizona and Sonora, no lack of raw material will be encountered in the application of this method of preparation."

Dr. N. L. Britton of the New York Botanical Garden describes in *Science* for March 24 the cotton found growing "in the extreme southern part of Jamaica in coastal thickets both in sand and on nearly level limestone rock where there is scarcely any soil." It was noticed over an area about a mile long and several hundred feet wide. Dr. Britton further says, "there is a total absence of weeds of cultivation, the cotton being associated with characteristic plants of the coastal lowlands. The flowers are small, the petals white with a crimson spot at the base, fading through the day to pink; the pods are small, nearly globular, the foliage pubescent or very nearly glabrous.

"There are no white residents at the place; the negroes say that the cotton was brought there in slavery times and planted, but the soil is such that no cultivation would be practicable and the remarkable absence of weeds indicates that no cultivation was attempted there; the negroes say that it was formerly collected and shipped. The occurrence of the plant at this place, associated only with native species, has given us a strong impression that it is indigenous though it may not be; at any rate it is a race

of cotton that has probably been quite unchanged from its pristine condition.

"It at once occurred to us that this race might prove a very valuable one for breeding purposes, inasmuch as it furnishes a new point of departure."

Dr. O. F. Cook's comment in the same number of *Science* is partly given below.

"Professor Britton's account of the conditions under which this primitive type of cotton grows would seem to establish beyond doubt that it is really a wild plant. The very small bolls and sparse lint would seem to preclude the idea that this cotton was introduced into the island for civilized agriculture. If not truly indigenous it must have been brought in aboriginal times, or by accident.

"The existence of wild cotton in Jamaica has been claimed by Macfayden and others, but the evidence has not been convincing. Macfayden described two species of cotton (*Gossypium jamaicense* and *G. oligospermum*) as native to Jamaica, but both are said to have yellow flowers and have been reckoned as forms of Sea Island cotton (*Gossypium barbadense*). White flowers are not known in any cottons of the Sea Island series. In the characters of the seeds and bolls Professor Britton's cotton closely resembles a type which grows wild on the Florida Keys."

NEWS ITEMS

Dr. J. M. Reade has been promoted from instructor to professor of botany at the University of Georgia.

Dr. Friedrich Hildebrand, professor of botany at Freiburg, recently celebrated the fiftieth anniversary of his doctorate.

Mr. W. W. Eggleston is making studies and collections of *Crataegus* in Virginia and North Carolina.

Professor G. W. Wilson, of Upper Iowa University, held a research scholarship at the New York Botanical Garden during the past summer.

Professor F. S. Earle, recently director of the Estación Agro-

nómica Central of Cuba, has accepted an appointment as agricultural specialist of the Cuban-American Sugar Company.

Dr. and Mrs. N. L. Britton left New York on August 22 for another botanical visit to the island of Jamaica. They expect to return about September 30.

Recent journals announce the death of Dr. Hermann Karston, the Berlin botanist, aged ninety-two years, and also that of Professor Daguillon, assistant professor of botany at the Sorbonne.

Dr. P. A. Rydberg, of the New York Botanical Garden staff, spent two weeks in the latter part of August in collecting in the Roan Mountain region of North Carolina and Tennessee.

Dr. Roland M. Harper gave a course of botanical lectures in July and August at the Biltmore Forest School, in North Carolina. He has since been carrying on botanical field-work in Georgia and Alabama.

In the distribution of the Bonaparte fund for 1908 by the Paris Academy of Sciences, the sum of 2,000 francs has been awarded to L. Blaringhem to enable him to continue his studies on the variation of species and the experimental methods of creating new species of plants.

The United States Forest Service has arranged for six sub-offices, to be situated in six cities which are centers of interest in forestry. Two of the cities selected are San Francisco and Denver, and one will probably be Portland; it is expected that offices will be opened in the states of Montana and Utah.

Fred Jay Seaver, M.Sc., assistant professor of botany in the North Dakota Agricultural College, has been appointed director of the laboratories of the New York Botanical Garden, succeeding Dr. C. Stuart Gager, who has accepted the professorship of botany in the University of Missouri. Mr. Seaver held the fellowship in botany in Columbia University during the year 1906–7 and was formerly professor of biology in the Iowa Wesleyan University.

# TORREYA

October,* 1908

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A MIOCENE CYPRESS SWAMP

BY EDWARD W. BERRY

Bartram writing before the American Revolution has this to say of the cypress: "This Cypress is in the first order of North American trees. Its majestic stature is surprising. On approaching it we are struck with a kind of awe at beholding the stateliness of its trunk. . . . The delicacy of its color and the texture of its leaves exceed everything in vegetation. . . . Prodigious butresses branch from the trunk on every side, each of which terminates underground in a very large, strong serpentine root, which strikes off and branches every way just under the surface of the earth, and from these roots grow woody cones, called Cypress knees, four, five and six feet high, and from six to eighteen inches and two feet in diameter at the base."

At the present time the bald cypress does not extend northward above latitude 39° which it almost reaches in both Delaware and Indiana. During the Pleistocene, however, following the final retreat of the ice it flourished considerably farther northward, buried cypress swamps of Pleistocene age being a feature of these and somewhat earlier deposits. They are exposed at innumerable points in our coastal plain from Maryland southward wherever the rivers have happened to cut into them, often exhibiting the remains of huge stumps with their wide-spreading roots and knees, the peaty matrix crowded with twigs, cone-scales, and seeds. It seems evident from this, and other evidence of a subfossil character, that at the present time the cypress is gradually becoming more restricted in its range. When we go back to

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* Dr. Gager's paper on Radioactivity and Life, which was to be a part of this number, will, unfortunately, have to be delayed.

the Tertiary period, however, a matter of a couple of million years or so, we find the cypress occupying a position to which its picturesque beauty entitles it, for its remains are found from Siberia and Spitzbergen across the arctic regions to Ellesmere Land, Greenland, and Alaska and southward over a large part of Asia, Europe, and America. Both Europe and Asia could claim it as a native plant up to the time the great glaciers came down from the north and forced it into the Mediterranean sea or against the fatal ice sheets that centered in the southern highlands of the Himalayas, Balkans, Alps, etc.

We in America have an almost unequalled series of early Tertiary deposits, but coming down to the latter half of that period we find our record much broken and scattered so that the botanist who would collect Miocene plants in any great variety must journey to Europe where there are innumerable localities of wide renown and great excellence.

Here in eastern North America our Miocene deposits are all marine and while they yield several hundred species of fossil shells often of exceeding great beauty, particularly in the Carolinas, they have only furnished thus far the scant remains of six species of fossil plants * preserved in a chance deposit in the District of Columbia.

Great interest therefore attaches to the recent discovery of indications of a cypress swamp along the ancient coastal estuaries of Virginia at a time when the diatomaceous deposits which now constitute the Calvert formation were being laid down off shore. During a recent visit to Richmond a considerable collection of fossil plants was made from these diatomaceous beds and a fair picture was obtained of some of the inhabitants of this far off cypress swamp.

First of all, the cypress twigs are preserved in greatest abundance, much broken to be sure, but indistinguishable as regards form and habit from their modern descendants. An occasional cone-scale was uncovered furnishing conclusive proof that we were not confusing cypress and sequoia, for a very abundant Tertiary

* An undescribed flora from southern New Jersey in the hands of Dr. Hollick may be of late Miocene age.

sequoia, *Sequoia Langsdorfii*, has twigs which greatly resemble those of the cypress. Then there were the seeds of the gum (*Nyssa*) showing that the tupelos were associated with the taxodiums even as far back as the Miocene. Along with the foregoing there was a species of willow (*Salix*) and one of water elm (*Planera*), another of water beech (*Carpinus*), an oak (*Quercus*) and an ash (*Fraxinus*), a fig (*Ficus*), and a button-ball (*Platanus*).

A large number of leaf fragments were unidentifiable as were also six or eight different varieties of seeds, but leaves of *Celastrus* were recognized as well as two kinds of leaflets of some members of the Leguminoseae. Another genus which was recognized was *Salvinia.**

It has always been a matter for wonderment that these great beds of diatoms could have been laid down and remain so free from land-derived sediments unless they were deposited in deep water far from any shore, which seemed improbable. The fossil plants just mentioned help us to a probable solution of this problem for they point unmistakably to the existence of cypress swamps and these in turn indicate that the land was low with sluggish and meandering streams so that the amount of sediment carried was reduced to a minimum or what was carried was entirely strained off, only the impalpably fine sediment which to-day makes the diatomaceous earth so argillaceous in places, succeeding in reaching the areas where the diatom skeletons were being deposited.

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* A complete account of this flora is in course of publication.

SHORTER NOTES

NOMENCLATURE.— The constant discussion now in progress concerning nomenclature may add to the interest of the following extract from Dr. George Sumner's leisurely treatment of the subject in his book entitled "A Compendium of Physiological and Systematic Botany" published at Hartford in 1820:

"In all ages it has been customary to dedicate certain plants to the honor of distinguished persons. Thus *Euphorbia* commemorates the physician of Juba, a Moorish prince, and *Gentiana* immortalizes a king of Illyria. The scientific botanists of modern times have adopted the same mode of preserving the memory of benefactors to their science; and though the honor may have been sometimes extended too far, that is no argument for its total abrogation. Some uncouth names thus unavoidably deform our botanical books; but this is often effaced by the merit of their owners, and it is allowable to model them into grace as much as possible.

"Linnaeus has in several instances drawn a fanciful analogy between botanists and their appropriate plants, thus —

> *Bauhinia*, after the two distinguished brothers, John and Caspar Bauhin, has a two-lobed or twin leaf.
>
> *Scheuchzeria*, a grassy Alpine plant, commemorates the two Scheuchzers, one of whom excelled in the knowledge of Alpine productions, the other in that of Grasses.
>
> *Dorstenia*, with its obsolete flowers, devoid of all beauty, alludes to the antiquated and uncouth book of Dorstenius.
>
> *Hernandia*, an American plant, the most beautiful of all trees in its foliage, but furnished with trifling blossoms, bears the name of a botanist highly favored by fortune, and allowed an ample salary for the purpose of investigating the Natural History of the Western world, but whose labors have not answered the expense. On the contrary
>
> *Magnolia* with its noble leaves and flowers, and
>
> *Dillenia*, with its beautiful blossoms and fruit, serve to immortalize two of the most meritorious among botanists.
>
> *Linnaea*, "a depressed, abject, Lapland (and American)

plant, long overlooked, flowering at an early age, was named by Gronovius after its prototype Linnaeus."

Specific names should be formed on similar principles to the generic ones; but some exceptions are allowed, not only without inconvenience, but with great advantage. Such as express the essential specific character are unexceptionable; but perhaps those which express something certain, but not comprehended in that character, are still more useful, as conveying additional information, for which reason it is often useful that vernacular names should not be mere translations of the Latin ones.

"Botanists occasionally adapt a specific name to some historical fact belonging to the plant or to the person whose name it bears, as *Linnaea borealis* from the great botanist of the north; *Murraea exotica* after one of his favorite pupils, a foreigner; *Browallia demisa* and *elata*, from a botanist of humble origin and character, who afterwards became a lofty bishop, and in whose work upon water I find the following quotation from Seneca in the hand-writing of Linnaeus: 'Many might attain wisdom if they did not suppose they had already attained it.' In like manner *Buffonia tenuifolia* is well known to be a satire on the *slender* botanical pretensions of the great French zoölogist, as the *Hillia parasitica* of Jacquin, though perhaps not meant, is an equally just one upon our pompous Sir John Hill. I mean not to approve of such satires. They stain the purity of our lovely science. If a botanist does not deserve commemoration, let him sink peaceably into oblivion. It savours of malignity to make his crown a crown of thorns, and if the application be unjust, it is truly diabolical."

JEAN BROADHURST.

TEACHERS COLLEGE.

REVIEWS.

Beccari's American Palms

Le Palme Americane della Tribu delle Corypheae. Odoardo Beccari. (Extracted from Webbia, vol. 2, Florence, 1907.)

In this valuable monograph Professor Beccari presents the results of many years investigation of palms and his work will be of immense interest and great assistance to students of these plants. In the tribe *Corypheae*, discussed in this volume, the American species are included in the following genera:

1. *Sabal* Adans. In this genus he recognizes eighteen species distributed from North Carolina to Porto Rico and Guatemala. He divides the genus into four series according to the size and shape of the fruit. Our observations indicate that the size of the fruit is not a good character to use, inasmuch as it varies greatly; the shape of the fruit is, however, apparently constant. He properly, in my opinion, declines to accept the genus *Inodes* Cook, which has as its only available character a tall upright trunk rather than the short and mostly subterranean one of *S. glabra* (Mill.) Sargent, the type species. From my knowledge of these trees in the field, I conclude that he has recognized one or two species too many. *Sabal Schwarzii* (Cook) Beccari, of Florida, has no chance to be specifically distinct from *Sabal Palmetto* (Walter) Lodd.; *Sabal Palmetto bahamensis* does not differ sufficiently from the type, if at all, to be entitled to recognition in nomenclature; *Sabal florida* Beccari, from Cuba, differs slightly from *S. Palmetto* in that the branchlets of the inflorescence are thicker, but the flowers, according to our dissections, are essentially identical. No mention is made of the Jamaica *Sabal*, very common in parts of that island, and sometimes attaining a height of 25 meters; its flowers are like those of *Sabal parviflora* Becc. of southern Cuba.

2. *Serenoa* Hook. f. This consists entirely of *S. serrulata* (Michx.) Hook. f., of the southern United States.

3. *Brahea* Mart. Here four species are recognized, three of them Mexican and one from San Salvador.

4. *Acoelorhaphe* Wendl. This generic name, published without a type in 1879, and therefore a hyponym, must give way to the generic name *Paurotis* Cook, Mem. Torrey Club **12** : 21. 1902, not mentioned by Professor Beccari. He recognizes two species, one from Cuba, the other from Florida, which do not seem to us to be distinct, and his descriptions call only for differences in the foliage. The genus is made up of the following elements : (*a*) *Copernicia Wrightii* Griseb. & Wendl., from Cuba ; (*b*) *Serenoa arborescens* Sarg., from Florida ; and (*c*) *Paurotis androsana* Cook, from the Bahamas. In my opinion these represent but one species, and the oldest name for it is *Wrightii.*

5. *Erythea* S. Wats. Four species are recognized from northern Mexico and Lower California.

6. *Copernicia* Mart. Nine species are recognized, five of them from South America and four from Cuba, including a proposed *C. Curtissii* from the Isle of Pines, which differs very slightly from the well-known *C. hospita* Mart. In this connection it is to be hoped that some light may be thrown on the record by Grisebach for the island of Jamaica of *Copernicia tectorum* Mart., otherwise known only from Venezuela, though erroneously attributed by Grisebach to Hayti. Careful search in Jamaica by Mr. Harris and by me has hitherto failed to reveal the presence there of any species of this genus, though it is possible that one may yet be found there. Professor Beccari evidently did not completely understand Dr. Morong's descriptions of *Copernicia alba* and *Copernicia rubra* from Paraguay, in Ann. N. Y. Acad. Sci. **7** : 245, or he might have used one of these names for the plant he proposes as *C. australis*, even if they are not specifically distinct.

7. *Washingtonia* Wendl. In this genus of southern California, Lower California, and Sonora, the three previously published species are recognized, together with two additional varieties, although he regards *W. Sonorae* as dubious and to be compared with *W. robusta.* He does not cite the equivalent names under *Neowashingtonia*, proposed some years ago by Mr. Sudworth, and makes no mention of *Washingtonia* Wendl. being a homonym ; it is a homonym, however, and a revertible one.

8. *Pritchardia* Seem. & Wendl. To this genus, which has eight recognized species in the Pacific islands (*P. pacifica* Seem. & Wendl. the type), Professor Beccari joins *Colpothrinax Wrightii* Griseb. & Wendl. of Cuba. We do not believe that this disposition of the Cuban tree can be satisfactorily maintained, notwithstanding the apparently slight generic differences shown by the fruit.

9. *Rhapidophyllum* Wendl. consists wholly of *R. Hystrix* (Fraser) Wendl. of the southeastern United States.

10. *Trithrinax* Mart. consists of five species from southern Brazil, eastern Bolivia, Paraguay, and the Argentine Republic.

11. *Acanthorhiza* Wendl. Two species are recognized, one from southern Mexico, the other from Panama, Costa Rica, and Nicaragua.

12. *Hemithrinax* Hook. f. consists wholly of *H. compacta* (Griseb.) Hook. f. from Cuba, known only from its original collection by Charles Wright.

13. *Thrinax* Sw. This is probably the most difficult of the American palm genera to understand, inasmuch as the foliage of most species is very similar and the differences in flowers and fruit are very slight. Professor Beccari accepts ten species, four of which he describes as new from Cuba, and discusses three dubious species. *T. microcarpa* Sarg., of Florida, *T. keyensis* Sarg., of Florida, *T. ponceana* Cook, of Porto Rico, and *T. bahamensis* Cook, of the Bahamas, I have studied in the field and regard them as one; *T. punctulata* Beccari, of Cuba, is very closely related, if not to be included in this aggregate. *T. tessellata* Beccari, from Jamaica (erroneously cited in Professor Beccari's key to the species as from Cuba) seems very distinct. *T. parviflora* Sw., of Jamaica, the type species, has very close congeners in *T. floridana* Sarg., of Florida, and *T. Wendlandiana*, of Cuba. *Thrinax excelsa* Lodd., as described by Grisebach, from Jamaica, is abundant on that island and distinct from *T. parviflora*, to which it is doubtfully referred by Beccari.

14. *Coccothrinax* Sarg. This genus, very distinct from *Thrinax* by the grooved endosperm of the fruit, has as synonyms *Thrincoma* Cook and *Thringis* Cook. Professor Beccari admits thir-

teen species, making his primary division of the genus on the number of the segments of the leaf and their relative length to the undivided part, a character which fails altogether in life, the leaves of young plants of species of this genus being often quite different from those borne by old trees, as may be readily seen in the Bahamas and in Jamaica. *C. argentea* (Lodd.) Sarg., the oldest species included in the genus, is restricted by Beccari to the island of Santo Domingo, and, according to him, little is known of it at the present time. In my studies I have been unable to satisfy myself as to the origin of the plant listed by Loddiges as *Thrinax argentea*, and I am not clear from Professor Beccari's discussion of the subject that it really came from that island. The Index Kewensis attributes it to Panama. On the other hand, the plant described by Professor Sargent from Florida as *C. jucunda* in 1899, and which, from my observation, has a wide range in the West Indies, throughout the Bahamas to the island of Culebra and to Jamaica, is more likely to be the true *T. argentea.* I am also unable to separate specifically from this species, the *C. Garberi* (Chapm.) Sarg., of southern Florida, as it seems to differ only in being smaller. In the collections made by Mr. Nash in the pine forests of the mountains of Hayti there is a species of *Coccothrinax* which appears to be wholly distinct from anything recorded by Professor Beccari.

15. *Crysophila nana* (H.B.K.) Blume, from southern Mexico, is regarded as dubious.

The volume will stimulate the study of American palms. A considerable number of the species are as yet known only from single collections of herbarium specimens and further collections will be needed, together with field observations and the study of living plants in conservatories, to establish them as valid. Meanwhile we thank Professor Beccari for his important contribution.

N. L. BRITTON.

SOME SIMPLE PHYSIOLOGICAL APPARATUS

By George E. Stone

The writer has for many years conducted a physiological practicum connected with botanical teaching, and as might be expected in any course requiring experiments, many methods and devices have been incidentally developed, some of which have proved fairly satisfactory in demonstrating certain principles, and others may find them suggestive in their lines of work.

Method of Demonstrating Difference in Transpiration Between Upper and Lower Sides of the Leaf

For demonstrating the difference in transpiration between the upper and lower sides of the leaves we have used the apparatus shown in figures 1 and 2, which illustrate a calla plant with the apparatus in place. It consists of two simple hygrometers 5 cm. in diameter, similar to those often used in cigar cases. These are attached to two pieces of metal tubing slightly larger in diameter than the hygrometers, each tube being about 4.5 cm. long. The hygrometers are placed in the end of each tube by means of rubber sheeting cut so as to fit tightly around the hygrometers. The rubber is then turned over the end of the metal and tied on with a thread. The tubes containing the hygrometers are placed on either side of the leaf, the ends of the tubes being supplied with rubber rings or bands so that the two halves of the metal cylinder, each containing the hygrometer, can be pressed against the leaf firmly but without injuring it. Glass tubes or even large corks may be substituted for metal if the proper size is obtainable. By taking readings of both hygrometers at the beginning of the experiment and at different times afterwards the relative difference in the transpiration between the upper and lower sides of the leaf is fairly accurately determined.

Method of Demonstrating the Effects of Various Factors on Transpiration

There are many simple experiments which may be done to illustrate the effects of various factors on transpiration. In our

FIG. 1. Method of demonstrating the difference in transpiration between the upper and under side of the leaf by means of hygrometers.

laboratory we have for a number of years made use of the apparatus illustrated in figure 3, which consists of a wooden stand mounted on legs, as shown in the illustration. This stand supports a large bell glass containing two apertures and in the center of the wooden stand there is a hole about one-half inch in diameter through which the plant is inserted into a tube below. The stem of the plant is forced down through the cork stopper into the tube containing water. A piece of flexible rubber cloth is tied around the bottom of the bell glass. The stem of the plant is put through a slit in the rubber cloth which is fastened to the plant securely by means of thread. From the lower end of the larger tube containing the stem of the plant

there are two small glass tubes bent at right angles at the extreme end which are attached to a meter stick, the lower ends of which are submerged in a vessel of water. One of these tubes has a calibre of about three millimeters in diameter; the other of about one millimeter or more. If the plant is transpiring very

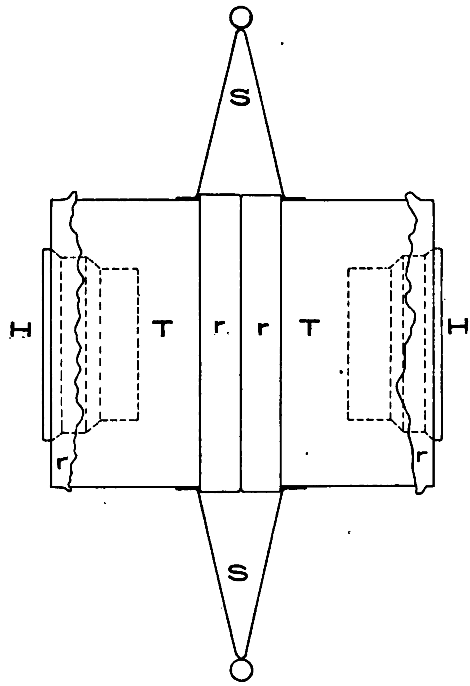

FIG. 2. Cross-section of transpiration apparatus. *T*, Metal tubes holding hygrometers. *H*, Hygrometers. *S*, Springs which hold the tubes close to the leaf. *r*, Rubber sheeting and bands.

freely the larger tube can be used, but if transpiring only slightly the smaller one will answer the purpose better. Connected with the large tube containing the stem is a reservoir or supply of water which is for the purpose of enabling the bubble to be placed anywhere on the scale desired by letting in water or by sucking it upwards. We have used this apparatus now for many years with considerable success. For our purpose we attach the bell-glass to a Chapman aspirator which enables one to draw air

of various degrees of saturation through the chamber, and by means of the bubbles the rate of transpiration can be determined. One can demonstrate the effects of ordinary laboratory air on transpiration or the effects of dry and moist air. The effects of dry air may best be determined by aspirating through sulfuric acid, which is much superior to calcium chloride. The effects of moist air may so be demonstrated by passing the air through water bottles, and the effects of warm air by heating very thoroughly a piece of gas pipe over a flame and aspirating air through it. In carrying on the various experiments a thermometer and

FIG. 3. Method of demonstrating effects of various factors on transpiration.

hygrometers may be placed under a bell-glass to indicate the changes in the air. This apparatus may be used to demonstrate the effects of chloroform, ether, illuminating gas, etc. on transpiration, and by the use of a simple mechanism the effects of movements or vibrations on the plant in the bell-glass may be determined, and in short, this apparatus may be used to demonstrate most of the fundamental factors underlying transpiration.

Devices for Percolating Air Through Soils

There is on the market a standard set of appliances adapted to the study of soil physics. Simple experiments to demonstrate the percolation of air and water through soils, capillarity, water retaining capacity, etc., are of value in connection with the study of respiration. An appliance is often used in connection with the experiments relating to the percolation of air through soils which is defective and unreliable, and the writer has made

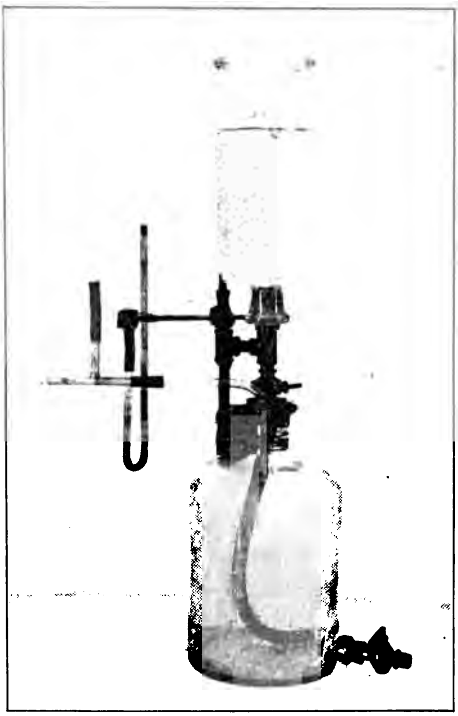

Fig. 4. Device for percolating air through soils.

use for a number of years of a form similar to that shown in figure 4. The principles underlying the present device for demonstrating the percolation of air through soils are not perfect, but the defects are of more theoretical than practical importance and could be easily remedied if necessary. The device

consists of a bottle holding about two gallons with an opening at the bottom provided with a valve. This is connected with a bell-jar overhead holding about a liter and a half, and in the operation one liter of water is allowed to pass very slowly from the jar above into the lower one. This causes a displacement of air; in other words, one liter of air in the lower jar is forced out through the tube shown at the left into the soil and the length of time it takes this liter of air to pass through certain soils is recorded. By using soils of different texture different values are obtained. The soils in an experiment of this nature are usually placed in metal cylinders of about 500 c.c. capacity, but lamp chimneys provided with corks at the bottom may be substituted, if necessary.

Connecting the tube with the lower jar there is a water manometer containing an inch or two of water in each arm, which determines the pressure of the air due to resistance to pressure through the soil, and when one liter of air is passed from the upper bell-jar into the jar below and the water columns remain precisely on a level, exactly one liter of air has been passed through the soil. The contrivances often used for this purpose are so clumsy and constructed on such poor mechanical principles that it is impossible to get the same results from the same soil twice, but by the use of the device described above, very reliable results are obtainable.

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Mr. J. A. Udden, of Rock Island, Illinois, reports in *Science* for July 31, a fossil cycad found in the Upper Cretaceous of Texas Eight fragments of what was presumably the same silicified trunk were found, three of these matched by their fractures and showed a stem about ten inches wide, hollow, and considerably flattened.

The *Century* for September has an illustrated article on the Future Wheat Supply of the United States, written by Edward C. Parker, Assistant at the Agricultural Experiment Station of the University of Minnesota. The methods of the wheat breeder are clearly described, and besides the economic information indi-

cated by the title the article contains a discussion of spring and winter wheats, rotation of crops, etc.

The Forest Service has issued a bulletin announcing that the supply of dogwood and persimmon in the southern States is nearly exhausted. These woods furnish, it is said, the entire supply of bobbins, shuttles, and spindles used in the cotton and woolen mills. Dogwood is said to be the only wood which takes a high polish and wears perfectly smooth by friction under water. Two large plants for the manufacture of bobbins and shuttles have been erected in Oregon, where the dogwood forests are the greatest in the world, the trees often reaching a height of 75 feet. Eastern manufacturers, however, are trying to find satisfactory substitutes nearer home, the most promising of which is probably the tupelo gum.

The *New York Tribune* announces that visitors to California will "have access to a third forest of giant redwoods when the counties of Tulare and Fresno complete construction of twenty-five miles of highway between Visalia and Redwood Canyon, in the Kings River country, where there is a grove of over fifteen thousand magnificent specimens of the Sequoia gigantea, many of which are said to compare in size and beauty with the trees of the Mariposa and Calaveras groups. It is probable that the property, which is as yet untouched by lumbermen, will be recommended to Congress for purchase as a national park. One tree in the redwood grove, recently measured by a government ranger, is 110 feet in circumference and is estimated to contain 800,000 feet of lumber. A claim is made that a fallen giant in the region is the largest in the country. Located at an altitude of less than six thousand feet, the canyon would be accessible for a longer period than the other giant groves in the state."

The *Plant World* for June contains a paper on stomata by Professor Francis E. Lloyd. The study upon which the article is based extended over the major part of three years. In order to determine the relation between transpiration and the size of the

openings, "it is necessary to be able to determine the rate of transpiration and the size of the stomatal openings independently at the same instant of time. It is obvious that we may neither judge the rate of transpiration from the size of the openings, nor the size of the openings from the rate of transpiration. How to do this was the difficult task, but with a sufficiently small error, this was done in the following manner:

"It was found that the stomata of certain, and probably many, plants may be fixed in the form in which they are found in life by tearing off the epidermis and plunging it into absolute alcohol. The distortion of the stomata caused by the tearing is only temporary, the guard cells recovering their form just as a rubber ball does when it has been released from pressure. The alcohol extracts the water from the cell-walls, thus rendering them rigid, and this it does so rapidly that they do not have a chance to lose the water contained within the protoplast while the walls are still pliable, a process which would result in closure."

Many series of experiments, mostly with the ocotillo, *Fouquieria splendens*, under varying conditions as to light, heat, humidity, etc., have led Professor Lloyd to the following conclusions: "With little or no movement in the stomata, and therefore with little change in the size of their openings, wide fluctuations in the rate of transpiration may and do occur;" and further, the evidence now in hand on the plants studied does not support the view that stomata are regulators of transpiration. "These are not markedly desert types as far as the stomata are concerned, and the amount of water-vapor which may escape through one type of stoma per unit of time may be greater or less than that which may escape through another type. The structure of the stoma, as that of other organs, may indeed explain why some plants are able to get along in the desert, and others not. Stomata of a given form may act as a dampener on transpiration, just as, using an analogy, the mute in a cornet reduces the amount of sound which emerges from the instrument. But the mute does not regulate the sound, causing now more and now less in successive intervals of time. In this sense, also, stomata cannot be said to regulate the flow of water-vapor from the leaf. Nor do they 'anticipate' wilting, the

closure of stomata during this process being as much a result of the wilting as the flaccidity of the other cells of the leaf. We must therefore give up for the present the long cherished notion that stomata are delicate valves opening and closing rapidly to modify the rate of transpiration as the needs of the plant indicate."

An interesting article on the manufacture and consumption of pulp wood* is given in *Science* for July 24: "The advance statement is made from the statistics collected by the Census Bureau in coöperation with the United States Forest Service. Many of the figures bring out interesting facts which show the rapid growth of the paper-making and allied industries during the last decade. Nearly four million cords of wood, in exact numbers 3,962,660 cords, were used in the United States in the manufacture of paper pulp last year," and over "two and one half million tons of pulp were produced. The pulp mills used 300,000 more cords of wood in 1907 than in the previous year. The amount of spruce used was 68 per cent. of the total consumption of pulp wood, or 2,700,000 cords. The increased price of spruce has turned the attention of paper manufacturers to a number of other woods, hemlock ranking next, with 576,000 cords, or 14 per cent. of the total consumption. More than 9 per cent. was poplar, and the remainder consisted of relatively small amounts of pine, cottonwood, balsam and other woods. There was a marked increase last year in the importation of spruce, which has always been the most popular wood for pulp. For a number of years pulp manufacturers of this country have been heavily importing spruce from Canada, since the available supply of this wood in the north-central and New England States.

*According to the New York Tribune for September 18, the Congressional committee appointed to investigate conditions in the paper mill and pulp industry reports plenty of pulp wood in the Middle West. One of the most important witnesses interviewed was William S. Taylor, president of the Pulp Wood Supply Company of Appleton, which organization furnishes pulp wood for twelve of the paper mills in the Fox River Valley; he stated that "his company buys about 225,000 cords of pulp wood annually, about 50 per cent. being spruce, most of which is purchased in Minnesota, and about 50 per cent. being hemlock, all of which is purchased in Wisconsin." Mr. Taylor is confident that "neither the present nor the coming generation need have any worry about the supply of pulp in the Middle West, for there are millions upon millions of feet available.".

where most of the pulp mills are located, is not equal to the demand."

The statement is made that only a "slightly greater amount of domestic spruce was used than in 1906. Large quantities of hemlock were used by the Wisconsin pulp mills, and the report shows that the Beaver State now ranks third in pulp production, New York and Maine ranking first and second, respectively, Poplar has been used for a long time in the manufacture of high-grade paper, but the supply of this wood is limited and the consumption of it has not increased rapidly. Wood pulp is usually made by either one of two general processes, mechanical or chemical. In the mechanical process the wood, after being cut into suitable sizes and barked, is held against revolving grindstones in a stream of water and thus reduced to pulp. In the chemical process the barked wood is reduced to chips and cooked in large digesters with chemicals which destroy the cementing material of the fibers and leave practically pure cellulose. This is then washed and screened to render it suitable for paper making. The chemicals ordinarily used are either bisulphite of lime or caustic soda. A little over half of the pulp manufactured last year was made by the sulphite process, and about one third by the mechanical process, the remainder being produced by the soda process. Much of the mechanical pulp, or ground wood, as it is commonly called, is used in the making of newspaper. It is never used alone in making white paper, but always mixed with some sulphite fiber to give the paper strength. A cord of wood ordinarily yields about one ton of mechanical pulp or about one half ton of chemical pulp."

NEWS ITEMS

Dr. Raymond H. Pond has been appointed biologist of the Metropolitan Sewerage Commission of New York.

The death of Dr. Hermann Settegast, aged ninety years, professor of agriculture at Berlin, has recently been announced.

Miss Margaret A. Kingsley, a graduate of Smith College, 1908, has been appointed assistant in botany at Barnard College, Columbia University.

The University of North Carolina has just completed a new $35,000 biological laboratory; associate professor W. C. Coker has been promoted to professor of botany.

Dr. William Mansfield, treasurer of the Torrey Botanical Club, has been advanced to the professorship of pharmacognosy in the College of Pharmacy of Columbia University.

Washburn College, Topeka, Kansas, has just established a department of botany and zoölogy; Dr. Ira D. Cardiff, of the University of Utah, will have charge of the botany.

H. J. Eustace, at one time assistant botanist at the New York Agricultural Experiment Station at Geneva, New York, has been appointed professor of horticulture in the Michigan Agricultural College and horticulturist of the experiment station. He graduated at the Michigan Agricultural College in 1901.

Mr. Alvah A. Eaton died at North Easton, Mass., on September 29, aged 43 years. He was the author of numerous papers on the Pteridophyta and contributed the treatment of *Equisetum* and *Isoëtes* to the recently published "Gray's New Manual of Botany." For the past six years he had been collector and assistant to Mr. Oakes Ames of the Ames Botanical Laboratory at North Easton. In this connection he made several expeditions to Florida in search of orchids.

The Torrey Club expects to have a lecture by Dr. J. C. Bose, professor in the University of Calcutta, India, author of "Response in the Living and Non-living," "Plant Response, as a Means of Physiological Investigation" and of "Comparative Electrophysiology," during his visit to this country during October and November. Dr. Bose wishes to visit the more prominent institutions of the east and middle west, and will be very glad to lecture on his researches free of charge to university audiences or before scientific societies. He may be addressed in care of Mr. R. N. Tagore, Box 135, University Station, Urbana, Illinois.

TORREYA

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THREE RARE MYXOMYCETES

By Henry C. Beardslee

Three of our rarest and most interesting species of slime moulds are doubtless *Cribraria violacea* Rex and *C. minutissima* Schw. and *Clastoderma DeBaryanum* Blytt. It has been my good fortune to observe all three of these in some abundance and the following notes are given in the hope that they may be of interest.

My first acquaintance with *Cribraria violacea* was made while working at the Illinois Biological Station at Havana, Illinois. A very few scattering plants were first found on some bits of wood which had been brought into the laboratory on account of an entirely different species which was growing upon them. The specimens were unmistakable and proved the forerunners of more abundant collections. Once it became apparent that this dainty species was to be found, close examination revealed it, never in large quantities, but so generally distributed in my collecting grounds that it became apparent that its "rarity" there was due merely to its minuteness; for it can scarcely be detected, as it ordinarily occurs, without the use of a lens. A few weeks later it was found under very different circumstances. My attention was called to an old log which was declared to have a violet metallic sheen. Upon examination the log proved to have a beautiful iridescence, which was visible in a bright light at a distance of several feet, due to the presence of an enormous colony of this rare plant, which had completely covered the surface of the log in such abundance as to impart its peculiar color to it. Doubtless this one log had upon its surface more of this species than has been observed elsewhere in the world. It was certainly an

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inspiring sight for a mycologist. Rex stated that the plasmodium of this species is deep violet-black, but unfortunately no trace o plasmodium could be seen on or in the log to verify this. About five stations for this species are reported.

During the same summer *Clastoderma DeBaryanum* was found at the same place. This species is also difficult of detection, though in a different way. The sporangium is globose, less than a fifth of a millimeter in diameter, mounted upon a stalk as fine as gossamer. When dry it is difficult of detection, and even when seen may readily be passed by under the impression that it is a mould.

A few scattering specimens were first found, but later a log was found and kept under observation which seemed to be completely filled with its plasmodium. This appeared at frequent intervals, covering the log with a pale yellow network of plasmodial threads, changing over night to a thick growth of the delicate sporangia. So far as I know this is the only time that its plasmodium has been observed with certainty. Later this species was found in Ohio and in North Carolina.

During the past summer the third species noted, *Cribraria minutissima*, was found in North Carolina, near Asheville. This seems the daintiest and most elusive of the Cribrarias. It is so minute that even after it has been found and mounted in the herbarium it is difficult to detect the delicate sporangia on the bit of wood which has been mounted. It seems to be fairly common at Asheville, but it is our most difficult species to locate.

Two facts doubtless account for the few recorded stations of these three plants. Their small size manifestly is one of these reasons. Upon an old log in dense woods each of them will defy any but the very closest scrutiny. In addition, it must be kept in mind that it is only when the sporangia have been formed that they are visible at all, and while the plasmodium may be present in large quantity, the period in which the sporangia are formed may be so short that it is easily missed.

At Havana, for instance, the beach along the Illinois River was thickly covered with old decorticated logs. These were examined regularly through the summer, three times a week.

Occasionally a few species of Myxomycetes were found in varying abundance, but usually they furnished a barren collecting ground. On one morning these logs everywhere along the river were found to be thickly covered with *Comatricha laxa* Rost. and *Enerthenema elegans* Bowm.

An endless amount of both species could have been gathered. Other occasions were apparently just as favorable, but at no other time did either species appear during that summer or the next.

It is easy to understand from an occurrence like this that a species may be present in large quantities in the plasmodial state and still fail to be observed even by a careful collector. Such a plant as *Cribraria violacea*, which has been detected at half a dozen stations stretching from Germany to Illinois, is in all probability general in its occurrence, but for the reasons given has failed as yet to be widely detected.

ASHEVILLE SCHOOL,
ASHEVILLE, N. C.

A TRAGEDY OF THE FOREST*

In the forests of tropical regions, where vegetable growth is rank and the resulting strife for supremacy very keen, many plants are forced to find a home upon the trunks and branches of trees. Among these are the greater part of the orchids and bromeliads, and many of the aroids, ferns, and hepatics of these regions, which thus often clothe the trunks and branches with a living mantle. Such, however, are harmless, for they work no injury to the trees which furnish them a home. But there are others which are not of this harmless nature. These have their beginnings as weak epiphytes, and from guests rapidly develop into masters, finally destroying the tree which gave them friendly shelter when young.

If you ever visit a tropical forest, seek for some of these. It will not take a long hunt to find one. Look in the crotch of some tree or on the stump left by some broken limb, or wherever a bit of humus has collected to furnish a foothold for the seed, and you may see a small plant, perhaps but a few inches or a foot

* Illustrated with the aid of the McManes fund.

or so high, with a few large obovate fleshy leaves. Descending from the lower part of the stem you will usually find a few long roots, harmless looking and in appearance much like dangling ropes. Here is the beginning of a tragedy, for unless something

FIG. 1. The *Clusia* forming a trunk and sending out lateral roots.

happens to kill this young plant, the tree upon which it has found a resting place is surely doomed.

It is some time before the fate of the foster-tree becomes evident, for the long roots must reach the ground and increase in diameter, several of them finally forming the trunk of the new

tree. On the left-hand side of the trunk of the tree, in the first illustration accompanying this article, where a limb has been broken away, one of these plants may be seen. Not only do roots descend, but some of them throw themselves around the tree, a

FIG. 2. The *Clusia* firmly established and lashed to the supporting tree.

feature clearly shown in the same illustration. The new tree is small as compared with its foster-parent, but look at the second and third illustrations which depict more advanced stages of the tragedy. In the former note how large have become the trunk-like roots and how many other roots have surrounded the trunk of

the foster-tree like great tentacles which are slowly but surely strangling it. It is but a short step now to the end, for soon the tree, which gave support and a home to the baby plant, loses its life, finally going into decay and falling away, leaving its one-time epiphytic guest master of the situation.

FIG. 3. A *Clusia* from Jamaica. (Photograph loaned by Dr. M. A. Howe.)

This is the tragedy as I saw it enacted many times in the forests of Haïti, where two of the photographs were taken from which the illustrations were made. The scene is laid on the north side of the island, about eighteen miles to the west of Cap Haïtien,

and not far from the little village of Port Margot. It is not necessary that you visit that particular locality, for nearly anywhere in a tropical forest you may see the same thing taking place. In this instance the ungrateful plant was *Clusia*, but there are other plants * which gain their ends in the same way. No wonder that in the English-speaking portions of the West Indies this plant has received the name of the "Scotch attorney," for when it once obtains a hold it never lets go while there is anything to be gained.

GEORGE V. NASH.

NEW YORK BOTANICAL GARDEN.

REVIEWS

"Gray's Manual," Seventh Edition †

The long anticipated seventh edition of "Gray's Manual" has appeared, and proves to be an attractive and carefully prepared work of 926 pages, quite copiously illustrated with small but generally clear and accurate figures scattered throughout the text. The arrangement followed is that of Engler & Prantl, and the plan of prefacing the treatment of the species in a genus with a specific key is generally adopted. The authors, or editors as they designate themselves, Professors B. L. Robinson and M. L. Fernald, of Harvard University, are to be cordially and sincerely congratulated on the successful termination of their work, which not only exhibits on every page the learning for which the authors are so well known, but shows every evidence of painstaking care and an evident desire to embody the latest researches

* The last report of the Missouri Botanical Garden has an illustrated paper on "The Florida Strangling Figs" by Dr. Ernst A. Bessey. Two species of *Ficus* are described; one (*F. aurea*) having the curious "habit of beginning its growth as an epiphyte and later becoming terrestrial by sending down numerous slender roots which eventually thicken and fuse together, finally wholly surrounding and strangling the host." The seeds of the same species require light in order to germinate; this peculiarity is no doubt related to its epiphytic habit. — EDITOR.

† Gray's New Manual of Botany (Seventh Edition — Illustrated). A Handbook of the Flowering Plants and Ferns of the Central and Northeastern United States and adjacent Canada. Rearranged and extensively revised by Benjamin Lincoln Robinson and Merritt Lyndon Fernald. Pp. 926. f. 1–1036. American Book Company, New York, 1908. $2.50. [Issued September 18.]

in the flora of the region covered. The belief which has prevailed in botanical circles in the past, whether rightly or wrongly, that propositions put forward by others would not be investigated solely on their merits by the Harvard botanists — a belief which the sixth edition of Gray's Manual unfortunately did so much to foster — will now happily have to disappear and be but a memory of the days that were.

By the above statements the writer does not, of course, mean that there are not many features in this edition of "Gray's Manual" open to criticism and strong differences of opinion, and no one will probably admit this more readily than the learned authors themselves. The first and probably the most obvious question, which will occur to any one after a careful perusal of this work, is why it is called "Gray's Manual." One can understand that as a commercial proposition it may have been deemed advisable to conserve the value of the advertising given to Gray's works in the past. Apart from this, however, there is so little left of the text of the old Gray's Manual, and the entire arrangement, nomenclature, style, type, and even cover of the book, have been so radically and fundamentally changed, that it seems to the writer a misuse of terms to speak of this work as a new edition of Gray's Manual. Indeed, so vast are the changes that the writer feels called upon to offer his condolences to those Bostonians of the old school for whom even the phraseology of the former editions of Gray's Manual has been almost sacred. In the present work they will find so much that is new that he is almost afraid they will be compelled to fall back on Dr. Britton's Manual to be again on familiar ground! To be serious, however, the authors are doing themselves an injustice in not calling the work what it really is. It is so nearly a new work that in accuracy it should be called "Robinson & Fernald's Manual." If the authors are too modest for this, calling it "Britton's Manual — Harvard Edition," would be more accurate than using the name which has been given, as in every respect it much more resembles Dr. Britton's work than it does Dr. Gray's.

In matters of nomenclature, the work unfortunately follows the arbitrary and unjust Vienna Code, not because the learned

authors believe in that code, but because they hope to keep American botany from an alleged "provincialism" in not following it. Americans in general, and Bostonians in particular, have in times past shown pronounced evidences of "provincialism" when dealing with certain European ideas of right and wrong, and the writer for one hopes that a similar "provincialism" will be shown in dealing with the Vienna Code. To select arbitrarily several hundred generic names as that Code does, and refuse to recognize them, although entitled to recognition under every rule of right and justice, is to the writer one of the most indefensible of propositions. The writer, of course, knows that the rule referred to is not one for which the authors of the work under review are responsible. He only hopes that, with the liberal mind they have shown in dealing with other questions, they will in the future join other American botanists in repudiating it.

Outside of the changes made necessary by recent discoveries, a very large percentage of the differences between this manual and other manuals of recent years, arises from this arbitrary rejection of certain generic names. The rejection of the rule "once a synonym, always a synonym" accounts for a small percentage of the differences, and the remaining arise almost entirely from what might be called a "conservative" generic treatment. Indeed, the generic treatment is rather disappointing. The authors have not given us their own ideas, as they have in the case of species, but have followed too closely the ideas of others. The same liberal treatment which the authors have applied to species would, I am sure, produce different results from those here given, when applied to genera.

While, as heretofore stated, the plan has generally been adopted of prefacing the treatment of species in a genus with a specific key, yet in many cases the plan of scattering a key through the specific descriptions has been followed. The result is a lack of uniformity, which at times is disconcerting. This matter, however, is of minor importance and detracts but little from the merits of the work.

So much, then, for the general features of this manual. It now remains for the reviewer to give a statement of the impressions produced on him by various portions of the work.

The treatment of the ferns and fern-allies naturally shows an improvement over the treatment given them in the sixth edition, but one is left wondering what the authors conceive to be the requirements for genera in these groups. Such closely allied genera as *Cheilanthes* and *Notholaena*, *Pellaea* and *Cryptogramma*, and *Asplenium* and *Camptosorus* gain recognition. On the other hand, *Athyrium*, now usually recognized as a legitimate genus, is not given a place in the work, and *Onoclea* and *Woodwardia* are made up of most heterogenous elements. The writer, of course, would not venture even to suspect an element of provincialism in the continued use of *Aspidium*, but does with becoming temerity venture to suggest the expenditure of some of the income from the sale of this work in the purchase of some genuine Dicksonias! Our North American plant so persistently referred to these tree-ferns may then be allowed to take its legitimate position. Again it may be suggested that while the treatment of *Lycopodium* shows a clear understanding of the New England species, the coastal forms of the *inundatum-alopecuroides* group plainly need further study.

One is glad, indeed, to see *Asplenium ebenoides* definitely characterized as a hybrid, and notes with satisfaction the more numerous family groups now recognized. *Isoëtes* and *Equisetum* have been carefully elaborated by Mr. Eaton, and the resulting arrangement is by far the best we have yet had for these variable and difficult plants. How saddening it is to remember that Mr. Eaton passed away almost simultaneously with the appearance of the results of his labors on the groups he loved so well.

Coming to the monocotyledons, one of the first genera which will strike the reader is *Potamogeton*. The artificial key here produced is apparently a very serviceable one and by not relying too exclusively on winter buds and glands avoids being too technical — a defect which makes Dr. Morong's key so difficult for the field worker to handle. Many changes in nomenclature, too, are made in this group, but these changes as well as the changes required in *Sparganium*, *Sagittaria*, and other genera placed early in the monocotyledonous series will generally commend themselves.

The grasses are handled in a masterly way by Prof. A. S. Hitchcock. He shows no reluctance to recognize recently proposed or revived genera, which commend themselves to his mind, and as a result we have a general arrangement, which will surely be regarded highly by all agrostologists. How greatly altered *Panicum* has become through recent study is shown by the fact that what in the sixth edition was treated as one genus with 25 species and about five varieties has here become six genera with 86 species and four varieties. Other genera, too, show very marked changes, but, of course, nothing like this.

The Cyperaceae also show the influence of new ideas, and in comparing the pages dealing with such genera as *Scirpus* and *Eriophorum* with the earlier editions, one unfamiliar with the recent history of the groups would scarcely believe the two editions represented studies in the same territory. *Carex* has been entirely changed, and very little, if any, of Professor Bailey's earlier treatment survives. A very elaborate and useful but not always accurate artificial key covering fourteen pages is one of the noteworthy features, and the time-honored division into *Vignea* and *Eucarex* is maintained. The statement on page 209, that the distigmatic species of *Eucarex* always have peduncled spikes, is valueless if it includes the terminal spike; and is incorrect, if it refers to the lateral forms of *Carex stricta* and *Carex Goodenovii*, as well as certain species not treated which are exceptions. The treatment of the subgenus *Vignea* is in the opinion of the writer the best ever given our eastern North American species. On the other hand, the treatment of *Eucarex* is less satisfactory, that of *Carex tetanica* and *Carex laxiflora* and their allies being especially weak. To discover errors in the key one might try to name *Carex flava* or *Carex acutiformis* by it.

The remaining groups of the monocotyledons also exhibit in many places the changes made requisite by recent studies. *Juncus* is credited with considerably fewer species disguised as varieties than formerly, and in *Sisyrinchium* the discriminating studies of Mr. Bicknell are rather closely followed. In passing it may be noted that the description of the plant called *Iris hexagona* is evidently based on specimens of the very different *Iris*

foliosa, the former being a tall plant with flowers conspicuously displayed like *Iris versicolor*, the latter a low plant with flowers hidden among the leaves. The treatment of the Orchidaceae is a disappointment, and but two of the views expressed in recent works by Dr. Rydberg are adopted, and these to a very small extent. His views may well not all be correct, but to reject them almost *in toto* is a fairly sure indication that they have not been given the consideration they deserve.

Of the earlier dicotyledonous families, the Salicaceae show the greatest changes and have undoubtedly been the most carefully studied. All the hickories but two receive names under *Carya* different from those in the sixth edition. Again we congratulate the staid Bostonians, as we also do on that pet of the Vienna rules, "*Maclura pomifera*", formed by arbitrarily ruling out Rafinesque's genus *Toxylon*, in favor of Nuttall's later *Maclura*, but recognizing as good Rafinesque's specific name published at the same time as his genus and tacking it on to Nuttall's genus. Verily a case of the tail being better than the head! *Polygonum* shows many changes, the results of Dr. Small's and Professor Robinson's studies being incorporated. Among the smaller genera the treatment of *Asarum* is noticeably deficient.

In general it may be said that so many changes have not been found necessary in the latter half of the work as in the first half, and many more of Dr. Gray's ideas continue to be there incorporated. Several groups, however, in which activity has been great in recent years are entirely changed. Of course, the most noticeable example of this is *Crataegus*, in which Mr. Eggleston, who professedly treats the group in a tentative way only, has done most excellent work. His group divisions apparently represent work of the most thorough character and the species he recognizes represent something more than individual trees. In glancing over the treatment of *Rubus*, however, one feels much inclined to join in the evident opinion of the editors that much more work must be done to understand the genus. It is evident, too, that the different groups of blackberries have been given a very uneven treatment.

Viola shows the result of the long continued and scholarly

study placed upon it by President Brainerd. *Solidago* has been carefully elaborated as far as the New England species are concerned, but the treatment of species not represented in New England is deficient in several respects. Similarly, Dr. Greenman's treatment of eastern *Senecios* is satisfactory, but he has not met so well the difficulties encountered in a study of the southwestern forms. The number of *Asters* recognized has been enlarged from 54 to 59 with many additional varieties; but, even with these additions, there are forms worthy of recognition which are not referred to.

Other features of this interesting work might well be discussed and many specific criticisms made, but space forbids. Omitted species of great distinctness are readily called to mind. Many of these could have been obtained by the authors for examination upon request. The value of the work is lessened and the botanical world has lost because they have failed to make the request. Many synonyms used in recent works are not referred to. But putting these and other points open to unfavorable criticism aside, the writer feels that he has had before him for examination a work of great merit. He has been both pleasantly and agreeably surprised by it, and he feels sure that it will be a welcome addition to the working equipment of all American botanists who are not too strongly committed to the old order of things, — the order exemplified by the sixth edition.

KENNETH K. MACKENZIE.

PROCEEDINGS OF THE CLUB

OCTOBER 13, 1908

The first meeting of the season, held at the Museum of Natural History, was called to order at 8:20 by Dr. Howe in the absence of other officers. Mr. George V. Nash was elected chairman. There were fourteen persons present. The minutes for May 27, 1908 were read and approved. The nominations of Mr. Michael Levine and Dr. Raymond H. Pond for membership in the Club were presented. The resignation of Miss Aurelia B. Crane to

take effect at the end of the present year was read and accepted. The resignation of Dr. C. Stuart Gager as secretary of the Club, occasioned by his removal to the University of Missouri, was read, and accepted with regret, after an expression of the value of his services to the Club. Dr. Pond was elected to membership.

The scientific program consisted of informal reports on field observations by members. Professor F. E. Lloyd was called upon first, and spoke of his recent experiences in Mexico. He exhibited field notes and photographs of cacti collected largely in northern Zacatecas, Mexico; in a restricted region, about sixty species are found. Four species of *Opuntia* are reported to be new; there were no species of *Echinocereus*. Owing to the fact that cacti in conservatories often exhibit very different behavior from that in their natural habitat, the importance of such field study of the group is to be emphasized.

Professor Lloyd then spoke on the bionomics of *Parthenium argentatum*, known in Mexico as guayule. From this plant a large amount of commercial rubber is obtained; the rubber occurs in masses in cells of the pith, medullary rays, and cortex, and is extracted by mechanical means. In addition to reproducing freely by seed, there is an interesting method of vegetative reproduction. The plant has, besides a tap-root system, long and slender horizontal roots near the surface, from which new shoots arise and produce new plants at a distance of a meter or more from the main plant. There may be from two to six of these shoots arising from one point, producing such a different habit that such plants may be easily distinguished from the seedlings with their single trunk. A piece of the stem of *Landolphia*, a tropical liana, was exhibited. In this case the latex coagulates in the canals and the rubber is extracted by mechanical means.

Mr. R. S. Williams spoke briefly of his five months' experience in Panama, particularly on the climatic and soil conditions as affecting vegetation.

Dr. E. B. Southwick exhibited a peculiar monstrosity of *Zea Mays*. Mr. Nash reported the discovery of the rare orchid, *Epipactis viridiflora*, at Letchworth Park.

Adjournment was at 10:05.

TRACY E. HAZEN,
Secretary pro tem.

OF INTEREST TO TEACHERS

Biology in Secondary Schools *

By Maurice A. Bigelow

Looking at the problems of high-school biology from the standpoint of the great majority of pupils, not from that of the selected few whose interests or plans may sometimes demand special arrangement of courses, my answer to the Departmental Editor's question, "Should the high-school biology be one based on the conception of biology as a single science, using plant or animal materials as occasion demands for developing principles, or should it be separate sub-courses or entirely distinct courses in botany, zoölogy, or human physiology?" is "yes" for the first part of the question and an emphatic "no" for the second part. And the following considerations point to such a conclusion:

The practical problems of the high-school curriculum, viewed from the standpoint of school administration, demand concentration of the biological work into one course *adapted for the great majority* of pupils. Here are the facts in support of this: (*a*) It is generally admitted that four science courses, one for each year, offer the maximum amount of science desirable for the average secondary-school pupils. (*b*) Chemistry, physics, botany, zoölogy, human physiology, earth science — a total of six — are the sciences which must be taken into consideration. (*c*) There are two possible solutions, namely, election or concentration. (*d*) Election means that pupils will fail to get a broad outlook on the field of natural science, and *possibly of all biology*. (*e*) Concentration of the biological work into one course would leave biology, physics, chemistry, earth science — one for each year of the high school. This looks reasonable from the standpoint of school administration, but is a year in biology satisfactory from the viewpoint of the biologist?

From many quarters we hear the objection that botany and zoology have developed into quite separate sciences; and this statement is true in most colleges where research for the few rather

* Reprinted by permission from *School Science and Mathematics*, October, 1908.

than liberal biological training for the many prevails. However, it is now high time that secondary-school teachers of biology begin to distinguish between technical zoölogy and botany viewed as courses leading directly to research and liberal biological courses designated to teach the great ideas or principles of the life sciences with reference to the needs of the average well-educated citizen. Viewed from this standpoint botany and zoology are not properly two sciences. And this is the standpoint which should be taken in secondary schools where the great majority of pupils are completing their formal education rather than preparing for college. More than anything else high-school teachers of biology need to study more seriously the problems of teaching the science with reference to the ideals of liberal secondary education considered as an end in itself rather than as college preparation. Viewed in this way the teaching of biology in the secondary school becomes the selection and presentation *not so much of the facts as of the great ideas or principles* which may be drawn from organized study of a series of plant and animal forms, and the unified course in biology becomes a logical necessity.

But from the four winds comes the protest that botany and zoölogy are so vastly rich in materials that even with a year for each they cannot be "finished." I must confess that I have not been able to get into sympathy with this protest. Why should we want to "finish" botany or zoölogy in one year or even in five, so far as secondary education is concerned? We do not "finish" other subjects in the high school. On the contrary we simply select materials for well-rounded year courses. Certainly we cannot complete a wide survey of either of the biological sciences in a single year, but there are great possibilities of selection when our outlook on high-school science becomes that of liberal education as distinguished from technical education. Take any current high-school book on zoölogy or botany and go through the pages critically questioning each paragraph from the point of view of education for general culture and information, and one is amazed at the amount of matter for which little justification is apparent. Eliminating such material of question-

able value, it seems perfectly feasible to combine the essentials, the great ideas, of the two phases of the science of life into a single course. Such a course with its broader outlook would be more valuable to the average educated citizen than would be either botany or zoölogy studied without reference to its sister science. Even laying entirely aside the practical problems of school administration, which are certainly tending to limit biology study to a single year for the average pupils, I believe that ultimately our high schools will adopt a year course in biology because such a course will best include the important values of biology in secondary education.

The above discussion has included only the information side of the values of high-school biological study. Limitations of space forbid appropriate discussion of the scientific discipline derivable from the study; but I fail to see any valid argument against the year in biology as far as discipline is concerned. On the contrary we may expect to get more valuable scientific discipline from the study of the more important subject-matter which would be concentrated into a year of biology. The possible objections all center around the idea that science study must be carried far into useless detail in order to give the best scientific discipline. This may be true from the research standpoint; but as applied to the everyday life of the average cultured citizen the results of such study of details have been far from satisfying. We seem to be moving rapidly towards that science study which is so correlated with information worth having that the discipline obtained will meet with greater application in practical life.

Summary. — The practical problems of the school curriculum seem to demand a course in biology for the majority of pupils, and there is nothing in the content of the science and in approved methods of teaching which opposes this. Considering the recognized values, a course in biology will tend to emphasize the great ideas or principles worth knowing, and there is no inherent reason why scientific discipline should not be as well developed as in any other high-school course in science.

Teachers College.

A paper by Dr. Ernst Friedrich, of the German commercial high school at Leipzig, contains the following interesting facts: The world's lumber trade amounts to $285,600,000 annually, of which the United States furnishes about 20 per cent., Austria-Hungary 19 per cent., Russia 16 per cent., Canada 13 per cent., Sweden 18 per cent., and Finland 10 per cent. Great Britain has but 4 per cent. of forest land; France, Switzerland, Italy, Greece, and Spain each less than 10 per cent. Even the newer countries, Chile, Argentine Republic, and Australia are forced to import wood.

The following abstract of a paper on "The Influence of Environment on the Composition of Wheat" by J. A. LeClerc and Sherman Leavitt, has been taken from one of the summer numbers of *Science*:

"Crops grown from the same seed at three points of widely different climatic conditions, such as Kansas, California, and Texas, forming a so-called triangular experiment, and similarly at South Dakota, California, and Texas, showed a marked difference in the protein content, the weight per bushel, the percentage of starchy grain, and total sugar content. Kansas produced invariably a high protein and California a low protein and high sugar content wheat. Wheat grown in California one year was found to double its protein content when grown in Kansas the next; the reverse was found to be true when Kansas seed was grown in California. These differences are due to climatic conditions. The composition of the soil seems to exert no influence on the composition of the crop."

Science for August 14 states that the appropriation for the Department of Agriculture for the present year is over eleven million dollars. The share of this granted to the Bureau of Plant Industry is larger this year, partly because of the boll-weevil work now being carried on. The appropriation for the introduction of rare seeds and plants from foreign countries was increased to $56,000, in addition to the congressional seed distribution, which is to be continued on the usual basis. The

Forest Service appropriation is also larger than last year. "The provisions of the previous year authorizing the extension of the national forests and the giving of advice to owners of woodlands as to their care were eliminated, but authority to aid other federal bureaus in the performance of their duties in respect to the national forests was granted, and advances of money may hereafter be made to chiefs of field parties for fighting forest fires."

Science for October 2 contains an article by Professor Thomas B. Osborne, of the Connecticut Agricultural Experiment Station, on "Our Present Knowledge of Plant Protein." In 1746, Beccari discovered wheat gluten, which was the only form of vegetable protein known for fifty years; after a sketch of the work done in this field from Beccari's time to the present, Professor Osborne states the results of a series of experiments performed in his own laboratory.

About twenty-five different proteins of vegetable origin, all of them the constituents of seeds, have been identified; some few, however, are also found in the active embryo. These have been assigned to the commonly recognized groups established for animal proteins. *Globulins*, or proteins soluble in solutions of neutral salts but insoluble in water, form the greater part of the reserve protein of all seeds except those of the cereals. *Prolamins*, soluble in alcohol and dilute acids but insoluble in water and saline solutions, occur in quantities in the seeds of most cereals but not in other plants examined. *Glutelins*, soluble in dilute acids and alkalis but insoluble in neutral solutions, constitute a large part of the protein of all the cereals and possibly of other seeds. The only known member of this group accessible to satisfactory investigation is the glutenin of wheat which forms nearly one half of the gluten. *Albumins* are present in very small amounts in nearly all seeds. They are more like the protein of animal origin than are the reserve proteins. *Proteoses* in small amounts have been observed in all seeds examined. No phosphorus-containing proteins similar to those which nourish developing animals have been found.

Of twenty-three different seed proteins which have been hydro-

lyzed, all have yielded leucine, proline, phenylalanine, aspartic acid, glutaminic acid, tyrosine, histidine, arginine, and ammonia. A fairly accurate analysis of arginine, histidine, and lysine has been made but not of most of the amino-acids.

The available data indicate a close connection between the chemical constitution of seed proteins and the biological relations of the plants producing them, though no two seeds are alike in respect to their protein constituents.

JANE R. CONDIT.

A GIFT TO TORREYA

A MEMORIAL TO MRS. JAMES MCMANES

As a memorial to Mrs. James McManes, of Philadelphia, her daughter has given to TORREYA the sum of two hundred dollars to be used for illustrations, beginning with the present number. This generous gift will not only make the magazine more attractive in appearance, but, for the coming year at least, will make it possible to secure many interesting papers for which the authors rightly insist upon illustrations.

Mrs. McManes's interest in botany was well known to her intimate friends; and while it did not definitely influence her larger institutional endowments, it was evidenced by such gifts as the giant cycad which for years has attracted the attention of visitors at the University of Pennsylvania.

NEWS ITEMS

At the University of Kansas, F. U. G. Agrelius has been appointed instructor in botany.

Dr. Homer D. House has been appointed associate director in the Biltmore Forest School.

Mr. R. J. H. DeLoach, of the Georgia Experiment Station, has been made professor of the cotton industry in the Georgia Agricultural College.

Mr. George L. Fawcett was recently transferred from the United States Laboratory at Miami, Florida, to the Experiment Station at Mayaguez, Porto Rico.

Mr. R. E. Stone, instructor in botany at the Alabama Polytechnic Institute, has been appointed professor of botany at the University of Nebraska.

Dr. I. F. Lewis, who has been studying at Naples and Bonn, has resumed his duties as professor of biology at Randolph-Macon College, Ashland, Virginia.

The Johns Hopkins laboratory and greenhouse have been completed; the gardens now include about three hundred types of plants illustrating pollination, seed dispersal, plant structure, and vegetative adaptation.

Appointments in biology not previously announced in TORREYA are those of Dr. David R. Whitney as assistant at Northwestern University and Mr. Charles Packard as instructor at Williams College.

Professor Thomas H. Macbride, of the University of Iowa, has been appointed chairman of the Iowa Forestry Commission which will coöperate with the national organization in promoting scientific and practical forestry.

A recent crown commission has outlined a plan for Ireland which proposes planting about 700,000 acres with forest trees. This, with the 300,000 acres of existing forest, would give Ireland 1,000,000 acres of forest land.

Dr. Ernst A. Bessey, pathologist in the United States Department of Agriculture, has been elected to the professorship of botany in the University of Louisiana, at Baton Rouge. He assumed his new duties on October 20.

The following deaths have recently been announced: Dr. Ernst Loeb, botanist, Berlin, aged sixty-six years; Mr. M. D. Clos, director of the botanical garden of Toulouse; Mr. George Nicholson, a former curator of the Royal Gardens at Kew; and Dr. Paul Hennings, curator of the Royal Botanical Museum at Berlin.

Mr. Harry Day Everett, a former student of forestry at Cornell and Michigan and superintendent in the Philippine Forest Service, was murdered by natives in the island of Negros in the early summer. He was twenty-eight years of age.

Professor L. H. Bailey has been given leave of absence from the College of Agriculture, Cornell University, to devote his time to the chairmanship of the commission appointed by President Roosevelt to investigate social and economic conditions of rural life.

At the University of Maine the following appointments have been made: V. R. Gardner, M.S., assistant professor of horticulture; C. E. Lewis, Ph.D., associate vegetable pathologist; M. R. Curtis, M.A., assistant in biology; H. N. Conser, M.S., instructor in botany; E. M. Wallace, B.A., instructor in biology.

Professor Francis E. Lloyd, formerly of Teachers College, has accepted the position of professor of botany at the Alabama Polytechnic Institute. During the past year Professor Lloyd has been engaged in the investigation of the Mexican desert rubber plant, *Parthenium argentatum* A. Gray, for a Mexican rubber company.

The Central University of Equador at Quito desiring to increase its museums invites the correspondence of parties who wish to exchange for collections of Ecuadorian fauna, flora, etc. Those who wish to secure any particular specimen or collection have only to apply to the rector or the secretary of the Central University of Equador at Quito.

An additional construction appropriation of $25,000 for the New York Botanical Garden, was approved in August; it will be expended in continuing the construction of driveways and paths, principally on the eastern side of the grounds, in the completion of the grading operations necessary at the museum building, and in the extension of the system of water-supply and drainage.

The *Pourquoi Pas* left Havre August 16 on a second voyage to the Antarctic regions. Dr. François Charcot, the commander, expects to be absent about two years. The *Pourquoi Pas* will reach the region of southern ice, 800 kilometers south of Cape Horn, at the beginning of the austral summer, about December 15. The marine botanist and zoölogist of the staff is Dr. Jacques Liouville.

The Forest Service, as a result of a recent conference between representatives of the War Department and the Forest Service, has received requests from Fort Mead, South Dakota, and Fort Leavenworth, Kansas, for an examination of the forests at those posts. In 1908 working plans were made by the Forest Service for West Point, thus supplying the post with part of the necessary forest products, such as cordwood, hurdle poles, and tan bark. Similar plans have been made for the military forests at Rock Island, Illinois, at Pecatinny, New Jersey, and at Fort Wingate, New Mexico.

The Hudson River Forest Preserve is discussed by Dr. Edward L. Partridge in *Country Life in America* for September, urging action by the State rather than by the National Government. A bill, he says, will be introduced in the Legislature of New York at its next session to create a Forest Reservation in this region, and he rightly adds that to give an object-lesson in forest reservation no more suitable region could be selected. The proposed bill provides that the State shall exercise a certain forest supervision over an area of more than one hundred and twenty-five square miles through which the Hudson River passes.

The College of Agriculture, Cornell, has planned an "educational special," carrying several members of the faculty of the College of Agriculture, which is to be run on several lines in central and western New York, stopping to allow for forty-five minute talks to the farmers about improved methods of farming. Ten days will be spent on this trip, which is being fully advertized, that the farmers may be prepared to ask questions. According to the New York *Tribune* a similar experiment has been tried this month by the Pennsylvania Railroad Company, representatives of the Pennsylvania State College of Agriculture leaving Philadelphia November 10, for a three-day trip in eastern Pennsylvania.

The corrected program of the Darwin anniversary meeting of the American Association for the Advancement of Science * is practically complete. According to *Science* the papers (which will probably be presented on Friday, January 1) are as follows :

* In the June TORREYA the preliminary announcement was confused with that of the summer meeting of the A. A. A. S. at Hanover.

T. C. Chamberlain: Introductory remarks as president of the association.

Edward B. Poulton: "History of the Theory of Natural Selection since Darwin."

J. M. Coulter: "The Theory of Natural Selection from the Standpoint of Botany."

D. T. MacDougal: "The Direct Effect of Environment."

C. O. Whitman: "Determinate Variation."

C. B. Davenport: "Mutation."

W. E. Castle: "The Behavior of Unit Characters in Heredity."

D. S. Jordan: "The Isolation Factor."

C. H. Eigenmann: "Adaptation."

E. B. Wilson: "The Cell in Relation to Heredity and Evolution."

G. Stanley Hall: "Evolution and Psychology."

H. F. Osborn: "Recent Paleontological Evidence of Evolution."

… TORREYA

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RADIOACTIVITY AND LIFE *

By C. Stuart Gager

1. The Supposed Radioactivity of Plants and of Wood

Soon after the discoveries of "contact" electricity and "animal" electricity by Volta and Galvani, plant physiologists began to look for electric currents in plants, and to find therein the explanation of "vital" activity. In a similar manner the announcement of the discovery of radioactivity has been followed by numerous supposed observations of a natural or acquired radioactivity of plants and plant tissues.

Professor A. B. Greene[2] was among the first to report that microörganisms, especially species of *Staphylococcus*, after an exposure of from 24–120 hours to radium rays at a distance of 0.5 mm., themselves exhibit phenomena of radioactivity. He considers it uncertain as to whether living organisms can acquire this property, but states that those killed by the action of radium rays can do so. In his experiments the radium salt was enclosed in a vulcanite and brass capsule, and the radioactivity acquired by the organisms lasted for three minutes after the termination of the exposure, and enabled them to photograph themselves on a sensitive plate. Their spores were found to be best for this purpose.

Lambert[3] stated in 1904 that ferments that digest albuminous matter emit Blondlot rays, and that the emission of these rays is the cause of the action of the soluble ferments.

The experimental demonstration of the emission of the so-

* This article, with the title "*Bio-radioactivity, Eobes, Radiobes*," forms Chapter V of the author's Memoir on "*Effects of the Rays of Radium on Plants*" (Mem. N. Y. Bot. Garden, vol. 4. Dec. 1908), and is reprinted here with the kind permission of the Director-in-Chief of the New York Botanical Garden.—Editor.

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called N rays by plants of the garden cress was reported by Meyer.[4] Their emission, he said, varies with the activity of the protoplasm, and is diminished when the plants are exposed to the vapor of chloroform, and is modified by mere compression of the tissues.

In 1904 Russel[5] described before the Royal Society the rather startling discovery of the action of wood on a photographic plate in the dark. This property, he said, belongs probably to all woods. Conifers are especially active, and the spring wood most of all, but the dark autumn wood produced no such effect. Oak, beech, acacia (*Robinia*), Spanish chestnut, and sycamore possess this property, but ash, elm, the horse-chestnut, and the plane tree only to a slight degree. Most resins manifest it, but not so the true gums, such as gum senegal and gum tragacanth. Exposure to sunlight, especially to the blue rays of the spectrum, increases the activity. Cork, printer's ink, leather, pure India rubber, fur, feathers, and turpentine are reported to have their activity increased in the same way. Since bodies such as slate, porcelain, flour, and sugar, in which there is no resinous or allied body, do not react in this way, nor affect the plate at all, the activity of the various kinds of wood is attributed to the resinous substances in them.

Tommasina's[8, 9] papers were also published in 1904. He reported that all freshly gathered plants, fruits, flowers, and leaves possess a radioactivity which is stronger in the young and in individuals in action than in those at rest, being apparently proportional to the vital energy. For this phenomenon he proposed the term *bio-radioactivity*. Buds of lilac, and leaves of *Thuja* and of laurel were found by him to be bio-radioactive.

In the following year Tarchanoff and Moldenhauer[7] published their preliminary note on the induced and natural radioactivity of plants, and on its probable rôle in their growth. When seeds of various grains and of the pea were exposed to the radium emanation, the seedlings growing from such seeds showed induced radioactivity in their roots, but the stem and small leaves remained inactive. Also when a mature plant was exposed to the emanation the roots became strongly radioactive, the stem somewhat less so, the leaves only slightly, and the flowers not at all.

This distribution of the radioactivity in the plant body is constant, and the authors consider that there is in the plant a special substance, sensible to the emanation, and capable of becoming radioactive under its influence. This substance occurs in the roots, but gradually diminishes up the stem. It is found also in seeds. According to this same paper plants possess a natural radioactivity, which is distributed throughout the plant similarly to the induced radioactivity. This natural radioactivity is strong enough to affect a photographic plate, and plays an important rôle in the development of the plant.

In a second paper Russel[6] gives a list of 33 native and 22 foreign woods that are active, and says that the activity of resins and gums is increased by exposure, not only to sunlight, but to the arc-light as well. Photographic plates often contain a negative of the plate-holder. That this is not a case of radioactivity appears to be proved, says the author, for a glass or a mica screen of one thousandth of an inch in thickness entirely protects the plate from being acted on.

Finally Paul Becquerel[1] undertook a careful study of "plant radioactivity." He tested pea seeds, moss (*Hypnum*), and branches of boxwood for radioactivity, but found not a trace of it manifest when the electroscope was carefully guarded from water-vapor. This explains the condition found necessary by Tommasina, that the parts of plants must be freshly picked in order to manifest bio-radioactivity. According to Becquerel, the discharge of the electroscope in Tommasina's experiments was due to the water in the plants.

From all the investigations noted above, the general conclusion seems to be warranted that radioactivity is not a property of protoplasm nor of living tissues. A clear understanding of the nature of radioactivity would lead, *a priori*, to the same inference.

2. The Professed Artificial Creation of Life

Radioactivity and vital activity are in two respects very roughly, but only very superficially analogous. Both radioactive bodies and living organisms are undergoing a destructive process; atomic disintegration in the one, molecular transforma-

tion in the other; both, with exceptions, maintain themselves constantly at a higher temperature than their surroundings. These analogies have in two or three instances proven dangerously attractive.

A consideration of radioactivity led Dubois,[18] in 1904, to the view that the distinction between "matter of life" and "living matter" is superficial. He proposed the term *bioproteon*, meaning the particular state of the "proteon" in living beings, and suggested the desirability of determining the radioactivity proper of the bioproteon. In a subsequent paper[21] he says: "The unique principle of everything, of both force and matter, I have called 'proteon,' and when it pertains to a living being, 'bioproteon'." Proteon and bioproteon are only two different states of the same thing. When the bioproteon is dead it has only ceased to be radioactive and becomes simply proteon. He claimed also to have discovered the emission, from the lamellibranch mollusc, *Phaladea dactyle*, of rays that could penetrate paper and opaque substances and darken a sensitive plate.

Early in the year 1905 appeared his paper[19] on "*La création de l'être vivant et les lois naturelles*" in which he announced the formation of living organisms in bouillon gelatine by placing on it crystals of the bromide of both barium and radium. Later in the same year[20] he claimed to have secured a kind of spontaneous generation by radium. By the contact of certain crystalloids with organic colloids, there are obtained, he says, granulations, or vacuolides, possessing the optical and and morphological characters of simple life, more rudimentary than bioproteon, or living matter. These bodies arise, grow, divide, grow old, and die, returning to the crystalline state like all living things, and Dubois applied to them the generic term *eobe* (dawn of life). Eobes are held to form the transition between the organic and the inorganic world. In his essay[21] on "*La radioactivité et la vie*," he elaborates the hypothesis that the energy irradiated by living beings has two distinct origins — one from the environment, and one ancestral or hereditary. By their "ancestral energy" living beings are similar to radioactive bodies. They both give off heat rays, light, chemical rays, electricity, and possess molecular motion, and atomic and other movements.

Leduc's[26, 27] profession to have created life was controverted by Bonnier,[10] Charrin and Goupil,[17] and by Kunstler,[25] in 1907.

The most extravagant claims made in this direction are those of Burke,[11-16] whose observations on the spontaneous action of radioactive bodies on gelatine media form the basis of a voluminous work entitled "The Origin of Life." While these experiments have little of the scientific importance they have been held to possess in the popular mind, it is desirable to state, in Burke's own words, what he did, and his own interpretation of the results.

"An extract of meat of 1 lb. of beef to 1 liter of water, together with 1 per cent. of Witter peptone, 1 per cent. of sodium chloride, and 10 per cent. of gold labelled gelatine was slowly heated in the usual way, sterilized, and then cooled. The gelatine culture medium thus prepared, and commonly known as bouillon, is acted upon by radium salts and some other slightly radioactive bodies in a most remarkable manner."[12]

When the mixture above described was placed in a test-tube and sterilized, and the surface sprinkled with 2.5 grains of radium bromide (activity not given), after 24 hours (three to four days when radium chloride was used), "a peculiar culture-like growth appeared on the surface, and gradually made its way downwards, until after a fortnight, in some cases, it had grown nearly a centimeter beneath the surface." From this growth Burke was not able to make sub-cultures. He considers them not bacteria, and not contaminations, but "highly organized bodies." They have "nuclei", subdivide when a certain size is reached, and "the larger ones appear to have sprung from the smaller ones, and they have all probably arisen in some way from the invisible particles of radium." He regards them as colloidal, rather than crystalline, "of the nature of 'dynamical aggregates' rather than of 'static aggregates'," and coins for them a new name, *radiobes.* This forms the experimental basis for a volume of 351 pages.

With reference to these discoveries, Dubois[22] claims priority over Burke, and rejects his term radiobe in favor of eobe, because these bodies may be obtained with non-radioactive substances.

A few months after Burke's announcement Rudge[28, 29] showed

that the alleged growths were "nothing more than finely divided precipitates of insoluble barium salts." He was unable in a preparation similar to the one described by Burke, to observe anything like cell-division, and believes that an occasional grouping of the particles in pairs must be purely fortuitous. The appearance of growth of the radiobes is explained as due to diffusion of the precipitate through the gelatine from a point of concentration where the radium salt was in contact with the gelatine. Salts of barium, lead, and strontium produced effects exactly similar to those caused by radium preparations.

Again repeating Burke's experiments, Rudge[30] was unable to secure the radiobes when agar-agar was substituted for gelatine and distilled water was used. If tap-water was employed a slight growth resulted, while the addition of a soluble sulfate resulted in a very dense growth. An examination of 30–40 samples of gelatine showed that they all contained enough H_2SO_4 to give a distinct, sometimes a dense, precipitate with barium chloride in the presence of HNO_3. This precipitate was found, on analysis, to be $BaSO_4$. Gelatine was then prepared free from sulfates and gave no growth. Negative results were obtained with salts of uranium, thorium, pitchblende, and metallic uranium, thus clearly indicating that there is not the slightest connection between the formation of the rabiobes and radioactivity.

A sample of gelatine from which H_2SO_4 had been removed was sealed with a radium salt from June until September. At the end of that time no growth appeared, but when a soluble sulfate was added to a portion of this gelatine the growth began at once.

"The cellular form of these precipitates," said Rudge, "is probably due to the circumstance that the gelatine is liquefied by the action of the salt, and each particle of precipitate is formed about a core of gelatine, so that the layer of barium sulfate forms a kind of sac or cell which is surrounded by the solutions of the salt in the liquefied gelatine. This 'cell' may be permeable to the liquefied gelatine containing a salt in solution, which, passing through the cell-wall, causes an expansion to take place, the limit of growth being controlled by some surface tension effect."

No trace of a nucleus or of mitosis was observed under the

very highest magnification, and "cells" under a cover-glass sealed down with cement were observed to suffer no alteration during four months.

Reference to the extreme claims noted in some of the literature above cited may be fittingly concluded by the following quotation from Lord Kelvin:[24]

"But let not youthful minds be dazzled by the imaginings of the daily newspapers that because Berthelot and others have . . . made foodstuffs they can make living things, or that there is any prospect of a process being found in any laboratory for making a living thing, whether the minutest germ of bacteriology or anything smaller or greater."

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New York Botanical Garden.

NOTES ON FERNS SEEN DURING THE SUMMER OF 1908

By Ralph Curtiss Benedict

Dryopteris Goldieana × *marginalis* Dowell.

A second locality for this interesting hybrid is to be recorded, the Green Lake region near Jamesville, N. Y., where so many ferns are found. The original collection of *D. Goldieana* × *intermedia* Dowell was made in the same region, and the trip in question had in view the finding of this fern, but it was not secured again although the parent species were seen in abundance and

often in close proximity. Two rather small but fruiting plants of *D. Goldieana* × *marginalis* were found, evidently off-shoots of a single original plant. The plants are now growing at the New York Botanical Garden where they will not only have good conditions for growth, but will also be protected from chance injury by cattle, or careless or ignorant collectors. It is suggested that rare hybrids constitute a type of plant which it is advisable always to protect by transplanting if proper care can be given them, since otherwise a locality may easily happen to be lost or destroyed.

Dryopteris simulata Davenport.

Two localities are here reported which it is believed extend the range considerably, at least in New York state.

At Quiver Pond, about one quarter mile south of the central part of Fourth Lake, Herkimer County, N. Y. The fern grew here in abundance, forming dense clumps on the higher portions of a sphagnum swamp. A few scattered plants of *D. Thelypteris* were also seen, but apparently it did not thrive there as well as its less common relative.

A second locality was noted at Horseshoe, St. Lawrence County, where the fern grew in a situation similar to that at Quiver Pond. So far as the writer knows the only previous collection north of the lower part of the state is that of H. D. House near Oneida Lake, and the occurrence so far to the north suggests that the fern may eventually be found in Canada. It is likely, too, that it will prove to be much commoner than has been supposed.

Dryopteris dilatata (Hoffm.) Gray.

On Blue Mt., N. Y., from about 3,000 feet to the summit. This find was of particular interest to me as it was my first opportunity to see this fern in its natural habitat. Its range was overlapped for perhaps two or three hundred feet (in altitude) by *D. intermedia* (Muhl.) Gray from which, however, it could easily be distinguished in size, shape, and texture. *D. spinulosa* (Müll.) Ktze., which in this country is usually considered to include the two preceding, was not seen at all.

The use of the binomial *D. dilatata* is in agreement with a common practice in Europe, and has been supported, and rightly as it seems to me, by many well-known fern students. *D. intermedia* (Muhl.) Gray, which does not occur in Europe, I believe to be similarly distinct, and hope later to give sufficient reason for this opinion.

Osmunda cinnamomea L.

Two aberrant forms of this species were noted during the summer. The first was a physiological freak, apparently a variant from the *frondosa* form which is known to occur on burnt-over land, as was the case at the locality in question, a roadside swamp in the town of Cornwall, Ct. The peculiarity of the *frondosa* form is the replacement of some of the fertile pinnae by green vegetative ones so that a single frond shows both sorts. In the present instance, the *frondosa* form was not seen but apparently the same result, an increase of the vegetative tissue, was attained. The fronds appeared strongly crested owing to a more or less irregular enlargement of the pinnulae which, besides being expanded and curled, were mostly deeply dentate. Few fertile fronds were seen.

The other form was first found by Miss Harriet Mulford near Hempstead, Long Island, where several plants were seen. Later I found two plants in the Cornwall swamp above mentioned. The peculiarity in this consisted in an excessive development of the lower basal pinnulae which in many cases were at least half as long as the pinnae themselves. As the fronds were nearly erect, and the pinnae about horizontal, the effect was to give the fronds a thick plumy appearance, making the plants exceptionally attractive from a horticultural standpoint.

Columbia University.

THE CEDAR OF LEBANON*

By Mary Perle Anderson

Religion, poetry, and history have all united to make famous the cedars of Mount Lebanon. Again and again they have been visited by the pilgrim, by the distinguished traveller, by the man of science. Grave doubts exist, however, as to whether the tree now known as the cedar of Lebanon, *Cedrus Libani* Barr, is the one so frequently mentioned in the Old Testament, for these cedars occupy a lofty and isolated position. They are twenty miles from the coast, in a rocky mountain valley at a height of six thousand feet on the side of Mount Lebanon, and about four thousand feet from its summit. Therefore they could have been transported to Jerusalem only with the greatest difficulty and expense. The wood, too, is inferior in color and durability to the wood of the more common cypress and juniper, and it is probable that one or the other of these more easily accessible trees was used for building purposes in the days of Solomon.

The botanical history of the cedar of Lebanon is less varied than that of many humbler plants. Tournefort called it a larch ; Linnaeus, a pine ; Poiret, a spruce. Dodonaeus named it *Cedrus magna*, and in 1714, Barrelier gave the tree its present name of *Cedrus Libani.*

During the sixteenth century it became so much of a custom to make a pilgrimage to the cedars of Mount Lebanon that it was necessary to take steps for the preservation of the trees, for the pious pilgrims carried away much wood for the construction of crosses and tabernacles. In this the Maronites were more successful than we of the present day in our efforts to preserve our forests and native wild flowers. They issued an edict threatening excommunication to all who should injure the trees. Not even a branch was allowed to be cut except once a year, when, on the eve of the Transfiguration, a festival known as the Feast of the Cedars was held, and an altar was built under one of the largest and oldest of the trees.

From the middle of the sixteenth century, we have the records

* Illustrated with the aid of the McManes fund.

of many famous travellers and scientists who visited the cedars. In 1550, Belon reports the number as twenty-eight, and says, "No other tree grows in the valley in which they are situated;

The Cedar of Lebanon in the Jardin des Plantes, Paris.

and it is generally so covered with snow as to be only accessible in summer." In 1574, Raiewolf gives the number as twenty-six, but adds, "There are two others the branches whereof are quite

damaged for age. I also went about in this place to look for some young ones but could find none at all." In 1655, Thévenot said that there were twenty-three trees, and a half century later a reliable witness writes of the cedars, "Here are some very old and of prodigious bulk, and others younger and of a smaller size. Of the former, I could reckon up only sixteen, the latter are very numerous."

In 1722, La Roque tells us that the largest of the trees had a trunk nineteen feet in circumference and a head one hundred and twenty feet in circumference. In 1744, Pococke says there are "fifteen large ones and a great number of young cedars." In 1829, Pariset writes, "There are not above a dozen large trees, but there may be 400–500 small ones," and in 1832, there is a note of pathos in Lamartine's simple statement, "There are now but seven large trees."

In the autumn of 1860, J. D. Hooker visited the famous trees and in the November number of the *Natural History Review* of the year 1862, gives a fuller account of them than his predecessors. In this article, we read that on the side of the mountain, the cedars "appear as a black speck in the great area of corry and its moraines, which contain no other arboreous vegetation, nor any shrubs, but a few small berberry and rose bushes, that form no feature in the landscape. The number of the trees is about four hundred; they form a single group about four hundred yards in diameter with one or two outstanding trees not far from the rest. They are disposed in nine groups corresponding to as many hummocks of the moraine on which they occur." With regard to number, Hooker says that there were only fifteen trees above fifteen feet in girth and only two others above twelve feet. As to size, they varied from eighteen inches to forty feet in girth. He himself says that it is a significant fact that there was no tree of less than eighteen inches girth, not even seedlings of a second year's growth.

The above records seem to indicate that conditions favorable for the germination and growth of new trees come only at long intervals in this isolated valley on the side of Mount Lebanon. What the conditions are that govern the increase of population

among these aristocratic and exclusive trees, and keep the number limited to the "four hundred" is a problem difficult to solve.

The date of the introduction of the cedar of Lebanon into England is not surely known, but Aiton in the Hortus Kewensis of 1838 places it in 1683, the date of the planting of the trees in the Chelsea Botanic Gardens. These trees first produced cones in 1766, and since that date, the tree has been largely planted on the great estates and in the stately parks and pleasure-grounds throughout England. The English climate furnishes conditions most favorable for its growth and to-day there are thousands of noble specimens with wide-spreading branches that add a grandeur and dignity to their environment that is too often wanting in our American parks which seem young and frivolous by comparison.

At Warwick there are many beautiful examples of the cedar of Lebanon. They lend their gracious dignity to the sturdy oaks and Scotch firs about them, and even the peacocks roosting in their branches lose their vain and silly airs and become transformed birds. Within the castle, there is a great room known as the Cedar Room. It is panelled from floor to roof with the rich dark red wood of the cedars grown on the estate, and "hewn and carved by men of Warwick during the last century," according to the guide who shows one about.

The cedar was introduced into France in 1734 when Bernard de Jussieu brought from London two plants, so small, that to preserve them more securely, he is said to have carried them in his hat. Just why the simple fact that he carried them in his hat should so have taken hold of the popular imagination is hard to explain. The theme, however, has been repeated again and again and with ever widening sweeps and variations. Long since the tale escaped from the realm of fact and soared into the high thin air of fiction. Perhaps it reaches its culmination in the second volume of "The Forest Trees of Great Britain" by Johns. When we consider that the facts of the case are all presented in the few words at the beginning of this paragraph, we are prepared to enjoy the frolic that results when imagination is let loose on botanical grounds. This is the touching tale of Jussieu and his hat and the cedar of Lebanon as presented by Johns :

"Many years ago a Frenchman, who was travelling in the Holy Land, found a little seedling among the Cedars of Lebanon, which he longed to bring away as a memorial of his travels. He took it up tenderly, with all the earth about its little roots, and, for want of a better flower-pot, planted it carefully in his hat, and there he kept it and tended it.

"The voyage home was rough and tempestuous, and so much longer than usual, that the supply of fresh water in the ship fell short, and they were obliged to measure it out most carefully to each person. The captain was allowed two glasses a day, the sailors who had the work of the ship on their hands, one glass each, and the poor passengers but half a glass. In such a scarcity you may suppose the poor Cedar had no allowance at all. But our friend the traveler felt for it as his child, and each day shared with it his small half glass of precious water; and so it was, that when the vessel arrived at the port, the traveller had drunk so little water that he was almost dying, and the young Cedar so much that, behold, it was a noble and fresh little tree, six inches high!

"At the custom-house the officers, who are always suspicious of smuggling, wished to empty the hat, for they would not believe but that something more valuable in their eyes lay hid beneath the moist mould. They thought of lace or of diamonds, and began to thrust their fingers into the soil. But our poor traveler implored them so earnestly to spare his tree, and talked to them so eloquently of all that we read in the Bible of the Cedar of Lebanon, telling them of David's house and Solomon's temple, that the men's hearts were softened, and they suffered the young cedar to remain undisturbed in its strange dwelling. From thence it was carried to Paris, and planted in the Jardin des Plantes."

The two trees brought by Jussieu from London lived and flourished. One was planted in the Jardin des Plantes, and the accompanying illustration shows it as it appears to-day, stately, symmetrical, and graceful, dominating that portion of the garden where it grows. The other tree is said to be even larger and more beautiful; it was planted at the Chateau de Montigny, near Montereau.

In the beautiful pleasure-grounds of St. Cloud, there is a group of younger cedars that were planted by Marie Antoinette. They have not yet lost their lower branches and so present a habit quite different from that of the mature tree.

When the cedar of Lebanon was first introduced into the United States is not known. In 1849, a specimen fifty feet high in the grounds of Mr. Ash at Throggs Neck was considered the finest in the Union. Unfortunately the climate of New England is too severe and changeable, and that of the Middle Atlantic States is not entirely favorable for its growth. It is hardy only in the South and in California.

In Central Park, in the vicinity of Eighty-fourth street, there is a promising specimen of the cedar that in habit resembles the cedars of Marie Antoinette. It is by the walk along the reservoir on the side towards the bridle path. In Prospect Park, Brooklyn, there is another young tree. There are older specimens in Flushing, and in Princeton ; in Philadelphia, in the arboretum of the Painters, there is a fine cedar that was planted at some time between 1840 and 1850.

Although the cedar of Lebanon may not be hardy with us, it is a matter for regret that since some attempts have proven successful, more efforts have not been made to cultivate this tree which would add a new element of beauty to our parks and gardens.

Two closely related cedars are proving better adapted to our climate : *Cedrus Deodara*, the Indian cedar, with its pendulous branches, and *Cedrus atlantica*, the Mount Atlas or Himalayan cedar, with rather erect branches. Of the two, the latter is the more hardy in this country. While both are desirable, neither can compete with *Cedrus libani*, the cedar of Lebanon, with its wide-spreading horizontal branches weighted with tradition and poetry.

Horace Mann School,
New York City.

REVIEWS

Urban's Symbolae Antillanae

The fifth volume of Professor Urban's valuable contributions to West Indian botany, published under the above title, has recently been completed by the publication of its third fascicle, and forms a volume of 555 pages. It includes a continuation of the bibliography of West Indian botany, written by Professor Urban, a monograph of the genus *Smilax* by O. E. Schulz; one of the family Celastraceae by Professor Urban; the Sapotaceae by M. Pierre and Professor Urban; Olacaceae by Professor Urban: Erythroxylaceae by Mr. Schulz; descriptions of new Compositae, and of a large number of new genera and species by Professor Urban. The work is thoroughly indexed.

These studies are of the highest importance to American botanists, and are throwing a flood of light on the relationships of West Indian plants. A very large number of species and genera new to science have been described, and many species incorrectly understood by previous authors have been elucidated, and their descriptions perfected. Much care has been taken to consult type specimens of the older authors and the amount of close study which the investigation has called for is very great; Professor Urban has the gratitude of American botanists.

Volume 4 of the Symbolae, given wholly to the flora of Porto Rico, is as yet uncompleted, two parts having been published several years ago. It is earnestly hoped that Professor Urban will soon be able to finish this volume, inasmuch as it will form a point of departure for all subsequent work on the flora of that island. It is a list of species with descriptions only of novelties, and no keys or other methods of determination are given; but a Porto Rico flora available for use by others may readily be prepared, using Professor Urban's work as a basis.

N. L. BRITTON.

PROCEEDINGS OF THE CLUB

October 29, 1908

The meeting was called to order at the New York Botanical Garden at 3.30 P. M., Dr. M. A. Howe being asked to take the chair. The minutes of the meeting of October 13 were read and approved. Mr. Michael Levine was elected to membership. Mr. Percy Wilson was elected secretary.

A microscopic preparation of the red snow plant, *Sphaerella nivalis*, collected this autumn on Cape York, was exhibited by Dr. N. L. Britton, who received it from the secretary of the Peary Arctic Club. Dr. Tracy E. Hazen gave a brief description of this interesting plant and raised certain questions still unsolved concerning it.

The first subject on the published program was "A Recent Collection of Mosses from Panama," by Mr. R. S. Williams. The following synopsis of this paper was written for the secretary by Mr. Williams:

"For the time spent in the field this was much the smallest collection of mosses ever made by the speaker. It may be accounted for partly by the fact that most of the work was done in the latter part of the dry season, namely, during the last week of February, through March, and about three weeks of April, and partly because of the low level, mostly under 300 feet elevation, at which much of the collecting was done.

"In the city of Panama are a number of fine old ruins more or less overgrown with shrubs and smaller plants but not a single species of moss was observed. On going to Penonome, some hundred miles west of the Canal Zone on the Pacific coast, the conditions were found to be much the same. One species of moss, however, was found abundantly fruiting in a cultivated field of cassava. This was *Bryum coronatum* Schwaegr., a world-wide species of the tropics and occurring as far north as Florida. On going a few miles back of the town, among the foothills and low mountains, various mosses become not uncommon, growing chiefly on trees, but even here very few species were obtained in

anything like good fruiting condition. On leaving Penonome a trip was made southeast of the canal along the Pacific coast about 100 miles to the Gulf of San Miguel, and up the Tuira river about 70 miles into the the interior to the mining camp of Cana. Here much more favorable conditions were found, Cana being situated at an altitude of 2,000 feet above the sea with the Espirito Santo mountains just back of the town, rising 5,000 feet higher. Mosses and liverworts were fairly abundant and at a more favorable season doubtless a large collection might be made.

"Of the 30 species brought back from both sides of the Canal Zone, five sixths are known to be South American. Two of these, *Pilotrichum amazonum* Mitt., collected originally by Spruce on the Amazon, and *Lepidopilum brevipes* Mitt., found by Spruce in the Andes at 3,000 feet, had not been since reported by any other collector. The five remaining species appear to be unknown outside of Central America. They are *Syrrhopodon Bernoullii* C. M.; a species belonging to the very large genus *Macromitrium*, apparently undescribed; a species of *Cryphaea*, also undescribed, and bearing numerous propagula on the stems; *Porotrichum cobanense* C. M. and *Cyclodictyon Liebmanni* Schimp., these last two being previously known only from the type localities."

The second paper, "The Morphology of *Taenioma*," by Miss Elizabeth I. Thompson, was not read, as Miss Thompson was absent.

Dr. N. L. Britton gave a brief account of *Rhipsalis*, a genus of the Cactaceae whose members are pendulous from tree trunks or rocks. Most of these plants occur in Tropical America, but a few species, strange to say, are found in tropical east Africa. Of the fifty-three species that have been recognized, the speaker discussed chiefly those of Mexico, Central America, and the West Indies, illustrating his remarks with herbarium specimens.

Dr. Tracy Hazen described in detail an interesting phase in the development of a species of *Chaetophora* found in the brook flowing through the herbaceous valley of the New York Botanical Garden. This investigation is, however, not yet complete. Dr. Hazen stated incidentally that the algal flora of this brook appeared to be considerably richer now than it was a few years

ago; and a discussion followed as to the presence of additional forms, some attributing it to insects, frogs, and other minor aquatic animals, and others to the wild ducks that frequent this brook through the summer season.

W. A. Murrill,
Secretary pro tem.

November 10, 1908

The Club met at the American Museum of Natural History and was called to order by Vice-President Burgess at 8:15 P. M. About 95 persons were present.

After the reading of the minutes of the meeting of October 29, Dr. N. L. Britton delivered the lecture of the evening on "Trees of the Vicinity of New York". The lecture was illustrated by lantern slides from the Van Brunt collection and was of a popular nature. The trees were taken up in a biological order, beginning with the gymnosperms, and the photographs exhibited illustrated both the general habit of the trees discussed and details of their flowers and fruit.

Marshall A. Howe,
Secretary pro tem.

OF INTEREST TO TEACHERS

The Camera Lucida for Class Demonstration

By Robert Greenleaf Leavitt

So far as I have seen, the use of the camera lucida for purposes of demonstration with classes, as now to be described, has not heretofore been put into print; though it is altogether likely that others beside myself have hit upon the device. The idea first occurred to me when showing visitors at the laboratory the workings of the compound microscope. The camera lucida always greatly pleases the uninitiated by its magical power of bringing the pencil into the field of the instrument, and of instantly conferring upon the novice the skill of the draftsman. It occurred to me, while exhibiting under the microscope and explaining some of the objects one usually shows to these people, such as algae or stained

sections of vegetable tissues which are not immediately comprehended by laymen, that by leaving the camera lucida in place I could point out to the observer the parts referred to in my attempted explanations. I fixed a paper upon the table top under the camera, hastily drew faint outlines of the objects in the field, and then, as my visitor gazed through the microscope, pointed with the pencil to these outlines, or, as the observer believed, to the various details within the scope of his vision.

When microscopes are to be used for demonstrating to classes illustrative material after lectures, or for brief examination of special preparations, by students in rotation during periods of general laboratory practice, the same method may advantageously be adopted. A not uncommon custom is to supply each microscope with a rough drawing, or with an illustration in an open book or on a chart. In the present method each microscope is provided with a camera lucida. Instrument, preparation, and paper are secured in place. The instructor adjusts things, and upon the paper in their proper positions writes the names of parts to which attention is to be directed, or places marks of indication, which afterwards to the students appear as labels in the preparations themselves.

State Normal School,
Trenton, New Jersey.

The *Outlook* for November 28 prints the following appeal from one of its readers: "Would it perhaps be timely to ask your readers if, after the terrible forest fires of this summer and autumn, it might not be considerate to refrain from using trees for Christmas decorations? Thousands of evergreens must be sacrificed annually to meet the demands of the Christmas trade. Is it a custom worthy of being perpetuated?"

The *Boston Herald* states that one New Hampshire neighborhood is to furnish about 10,000 Christmas trees for Philadelphia. Several acres of young woodland is to be stripped of fine, young spruce trees, for which the owners will receive no more than six or seven cents each. The *Herald's* correspondent further says the "trees are sacrificed for only a few hours' enjoyment, and

the people in this locality are deploring the denuding of the land on this account."

The *Outlook* also prints a letter from Mr. Alfred Gaskill, state forester of New Jersey. It runs as follows:

"It is sometimes difficult to be patient with those who urge the abolition of Christmas greens for the sake of the forests. To what better use can a tree be put than to gladden half a dozen, or half a thousand, child hearts on Christmas Eve? Is the lumber from a whole forest worth one telling of the legend of the *Weihnachtsbaum?* But the hope expressed in your issue of November 28 that there may be a way to have Christmas trees and forests too leads me to say that the fears of those who love the forests more than the children, or at least seem to do so, are groundless. If every family in this land had a fifteen-year-old Christmas tree every year, they could all be grown without difficulty on a third of a million acres, or less than one seventh of the forest area of this little State of New Jersey. Of course the cutting of trees as now carried on in Maine and elsewhere looks destructive, and often is destructive, yet the trouble is not with the business but with the way it is conducted. In other words, Christmas tree growing can and should be a regular industry. The trees can come in part from necessary thinnings in lumber stands, in part from plantations made for the specific purpose. It is quite as legitimate to plant a piece of land with balsam for Christmas trees as with peach trees. Both kinds will be cut down at about the same age. Several property-owners in this State are definitely planning to grow Christmas trees on land that is now yielding no valuable crop. The planting will convert ugly brown slopes to hills of green, for some years at least, and the venture promises to be a paying one.

"With respect to greens the case is not very different. The supply now comes mainly from waste places and is gathered by poor people who get their Christmas in that way. Holly is a most beautiful tree and its wood is valuable, yet scarcely a specimen found north of Virginia would yield as much in lumber as in greens. Laurel, or Kalmia, is the most generally used woody plant, and that use, too, ought to be legitimate. There is no de-

fense of the practice of stripping fence rows and park woods, and it should be stopped. But laurel is a forest weed; it interferes with the development of young trees and is a nuisance where silviculture is practiced. We have in this State an area of 15,000 or 20,000 acres on which 'nothing of value will grow—only laurel and scrub-oak.' I do not know who owns this land, but I do know that the glory of the flowers in June does little toward paying taxes, and I am quite sure that any one who wants to gather greens there will find little objection.

The problem of Christmas greens, if it be a problem at all, can be solved by the simplest measures of control. Restrict cutting of trees or shrubs where the act will cause a disfigurement, but encourage the use of all the evergreen plants, and their propagation, as a means of making the earth more fruitful. Trees are for use, and those who would save every tree must be reminded that mere saving is waste. The wise, the necessary thing is to make them satisfy the needs of man; some for an hour's delight at Christmas time, some for warmth and shelter, all to delight the eye and cheer the heart until the time for sacrifice comes.

Change of sex in plants is the subject of an article by Mr. M. J. Iorns, of Porto Rico, in *Science* for July 24. The following is quoted in part only: "While change of sex among the phanerogams is not unknown yet it is of such rare occurrence that any well-demonstrated instances as those shown by the Caricas under observation are worthy of careful study. This is especially true when that change can be brought about by cultural methods as seems to be clearly proved in the present instance.

"*Carica papaya* is a tropical, rapidly growing tree-like form belonging to the Passifloreae family. As found in Porto Rico it is distinctively dioecious, the monoecious form being very rare except when produced as were the ones under observation. The tree is non-branching, but will readily develop lateral buds if the terminal bud is destroyed." The staminate flowers "developed successively, continuing over a long period of time, so that there is no time during the year when flowers are not shedding pollen. The pistillate tree bears axillary flowers of a very different form

from the staminate" which are borne on an unbranched peduncle usually varying in number from one to five. "Of these only one, with rare exceptions, sets fruit. It is said that the flowers are sometimes perfect, but such have not come under my notice as yet. The fruit varies in form from oval to a distinctively necked pear shape and in weight from three pounds to ten pounds or even more. The fruit in some varieties is very delicious and has many medicinal properties ascribed to it, so that the plant is of enough value economically aside from its botanical interest to be worthy of careful study.

"The change of sex in the first tree noted was brought about accidentally. A staminate tree of some age had its terminal bud accidentally injured. The staminate flower clusters produced shortly afterwards contained pistillate flowers in the terminal group. These flowers set and developed good-sized fruits."

The natives stated that the "removal of the terminal bud in the new of the moon would usually cause this transformation. Other trees growing on the grounds were at once set aside for experimental purposes and the tops were removed at different phases of the moon to disprove the moon's having any effect and also to show, if possible, what were the necessary conditions, if any, outside of the mere removal of the terminal bud. Thus far it is clearly shown that the removal of the terminal bud does cause the change, but also that some other condition is necessary, as only a part of those thus treated have thus far developed any pistillate flowers. The moon's phase does not appear to have any control, though, strange to say, those treated at a fairly definitely recurring period are the ones that show change. It is possible that the plant has definite short cyclic periods of growth and that it is necessary to remove the tip at some definite phase of this cycle in order to produce the development of fertile flowers. If this be true and this cycle should accidentally coincide fairly well with the moon's phases, the belief in moon influence would naturally arise.

"This view of an approximately monthly periodic cycle of growth has several things to support it. The chief of these is found in continuous development of flowers and fruit. At no

time during the year were the trees under observation without both flower and fruit. On the other hand, there are times when growth is more rapid, more flowers are developed and the terminal nodes elongate much more rapidly. The exact time of these periods has not yet been determined definitely, but data are being collected.

"The habit of the plant is being closely studied to determine the characteristics of each change and at what point in this growth the tips must be removed to produce the changes under discussion. It is possible that the power to produce pistillate flowers is inherent in the plant, being dormant unless some shock is given to destroy the equilibrium of the growth forces. This inherent quality is indicated by the fact that in some countries the plants are sometimes found naturally monoecious."

NEWS ITEMS

Kohang Yih, of China, is investigating the tobacco industry in the United States.

Oberlin College has recently received from Mrs. Mary F. Spencer a collection of several thousand European plants.

The Yale Forest School has recently acquired a thousand more acres at the reservation near Milford, Pennsylvania.

The Transvaal is planning an agricultural college; Dr. F. M. Smith is here making a study of American management.

Dr. J. E. Kirkwood, formerly of Syracuse University, is now at the Tucson Desert Botanical Laboratory engaged in research work.

Dr. Carl L. Alsberg, of the Harvard Medical School, has resigned to conduct the Department of Agriculture investigations on poisonous plants.

Mr. W. S. Harwood, of California, the author of "New Creations in Plant Life, or Life and Works of Luther Burbank," died in November.

Dr. Shigeo Yamanouchi, assistant in botany in the University of Chicago, is spending three months at the marine biological station at Naples.

Professor Charles R. Barnes and Dr. W. J. G. Land, of the University of Chicago, are in Mexico collecting research material, principally mosses.

The National Conservation Commission after six months' work held a meeting in Washington early in December to prepare the report requested by President Roosevelt.

Mr. Joseph H. Painter, aid in the Division of Plants of the U. S. National Museum, met death by accidental drowning in the Potomac River, December 6.

The Bartram Association has placed in the charge of Professor Macfarlane, of the University of Pennsylvania, the annual planting of a new tree in the Bartram gardens.

An American table is again being supported by Columbia University at the Naples biological laboratory. Applications may be sent to Professor E. B. Wilson at Columbia.

Dr. William A. Murrill, assistant director of the New York Botanical Garden, sailed for Jamaica on December 5. He plans to spend five or six weeks in collecting the fungi of the island.

Dr. Roland M. Harper has accepted a position with the Florida State Geological Survey, with headquarters at Tallahassee, and will be engaged during the winter in studying the origin, classification, distribution, and extent of the peat deposits of that State.

Beginning on December 28, the New Jersey State Board of Agriculture will give a six-day course for farmers at the Agricultural College in New Brunswick. About nine lectures are to be given each day on such varied subjects as farm manures and fertilizers, stock breeding, orchard and fruit trees, injurious insects, seed testing, and plant breeding.

The New York Academy of Sciences will observe Darwin's birthday, February 12, 1909, by presenting to the Museum of Natural History a bronze bust of Darwin and holding appropriate exercises, which will include an exhibition of material illustrating Darwin's theory of evolution and also indicate the range of his scientific work.

The Baltimore meeting of the American Association for the Advancement of Science, which begins December 28, includes, besides the sessions of the Section G, Botany, meetings of the following societies: American Federation of Teachers of the Mathematical and Natural Sciences, the American Society of Biological Chemists, the Botanical Society of America, Sullivant Moss Chapter, and Wild Flower Preservation Society.

Some weeks ago at the Chicago meeting of the board of trustees of the Marine Biological Laboratory at Woods Hole, measures were taken to institute a central board composed of representatives from the various stations engaged in marine work. Fourteen biological stations are at present included. Professor N. L. Britton (of the Torrey Club) represents the Cinchona Station of the New York Botanical Garden.

The new field organization of the Forest Service is well under way. The 377 foresters, clerks, and stenographers who are to make up the personnel of the service have been assigned to the six offices previously announced: Denver, Colo., Ogden, Utah, Missoula, Mont., Albuquerque, N. Mex., San Francisco, Cal., and Portland, Oreg. Much of the national forest business which formerly was transacted in Washington will now be handled by officers on or near the ground, which is a distinct improvement.

Mr. J. G. Lemmon, a pioneer botanist of California, died at his home in Oakland, November 24, aged seventy-six years. He served in the Civil War, came to the high Sierra Nevada to recuperate his shattered health, and under the inspiration of Asa Gray, collected plants and distributed widely his specimens, many of which represented species described as new by the botanical staff at Harvard. He was California State Forester from 1886 to 1890 and the author of numerous papers concerning west American trees.—W. L. Jepson.

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New names and the names of new genera and species are printed in **boldface type.**